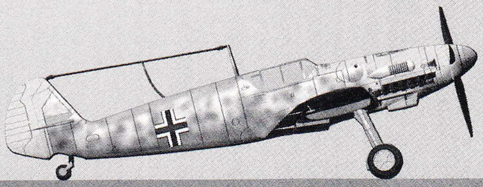

DIGITAL
COMBAT
SERIES™

Luftwaffe COMMANDER™

WWII COMBAT FLIGHT SIMULATOR

USER MANUAL

SSI®

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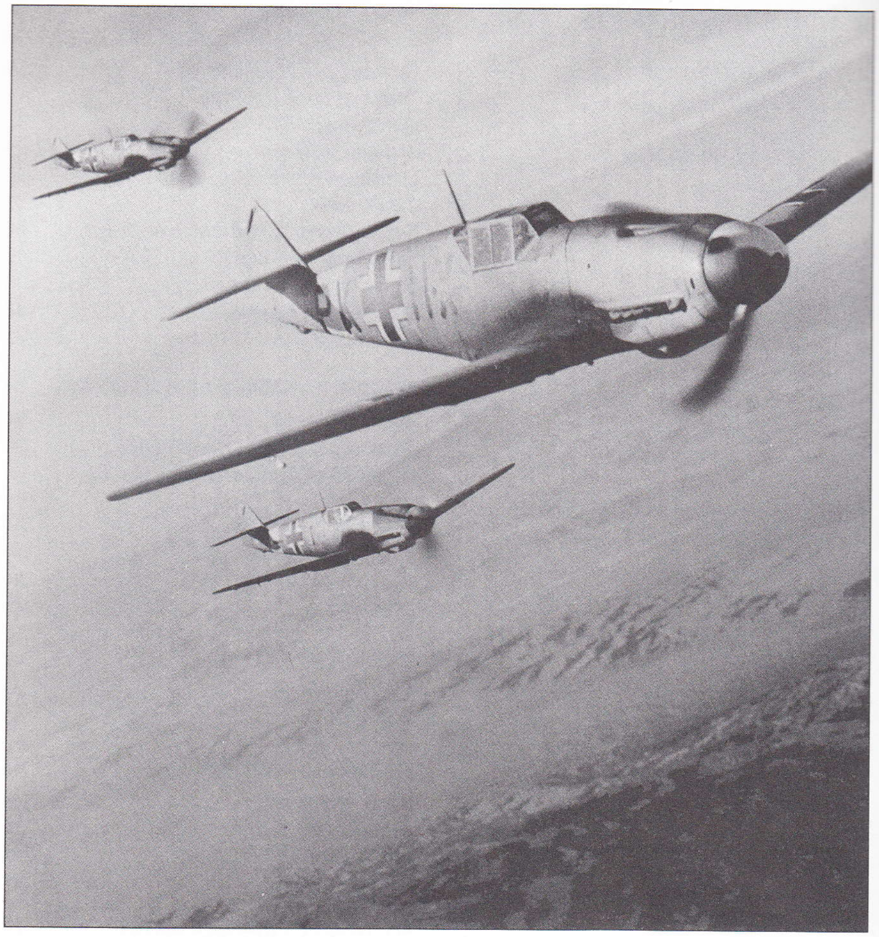


■ ACHTUNG! ATTENTION!

LUFTWAFFE COMMANDER is the second in the SSI Digital Combat Series of simulations. In LUFTWAFFE COMMANDER you can experience the entirety of WWII in the cockpits of some of the most realistically modeled fighters ever flown on a computer. In missions in five theaters of action from sunny Spain to frigid Russia, from the Spanish Civil War to its end over Germany, LUFTWAFFE COMMANDER puts you behind the stick and up in the air in planes that range from pre-war biplanes to the jets flown in the final days. In LUFTWAFFE COMMANDER you can fly as long as you live!

What Comes with this Game?

Your game box should contain this user manual and a LUFTWAFFE COMMANDER CD. This user manual explains how to play and contains important information on menus, scenarios, and unit classes and equipment. To get the game running on your computer, see the installation instructions following.

■ SYSTEM REQUIREMENTS

To play LUFTWAFFE COMMANDER, be sure
system requirements:

- Pentium 166 MHz IBM PC or
- 32 MB of RAM
- Windows® 95 or 98- NOTE:
  systems. Multitasking is not
- An **Uncompressed** hard drive
- 8 X CD-ROM drive or faster
- A SVGA video adapter with 2
- A 100% Microsoft (or Logitech)
- Microsoft mouse driver version
  6.24 or higher

In addition to the basic system
installed to your hard drive. The
installation. At the end of installation,
electronically. For network play, you

Installing the Game

You must install LUFTWAFFE
LUFTWAFFE COMMANDER CD in your

To install the game, insert the CD
appears, click on the Install option.
if it does not function, Explore the
on-screen prompts to complete the

Starting the Game

The LUFTWAFFE COMMANDER Autorun
game, Install DirectX, Uninstall the
CD-ROM drive is closed with the CD
by opening the Start menu, selecting
COMMANDER was installed and
item. The other item in that folder is
create or edit scenarios on your own.

oat Series of simulations. In WII in the cockpits of some mputer. In missions in five the Spanish Civil War to its the stick and up in the air lown in the final days. In

WAFFE Commander CD. This nformation on menus, sce- unning on your computer,

■ SYSTEM REQUIREMENTS

To play Luftwaffe Commander, be sure your system meets the following system requirements:

- Pentium 166 MHz IBM PC or compatible
- 32 MB of RAM
- Windows® 95 or 98- NOTE: This game cannot be played on Windows® NT systems. Multitasking is not recommended when playing Luftwaffe Commander
- An **Uncompressed** hard drive with 195MB free for the "Recommended" install
- 8 X CD-ROM drive or faster
- A SVGA video adapter with 2 MB of memory and a Color SVGA Monitor
- A 100% Microsoft (or Logitech) compatible mouse
- Microsoft mouse driver version 9.00 or higher or Logitech mouse driver version 6.24 or higher

In addition to the basic system requirements, the game requires that DirectX 6 be installed to your hard drive. The option to install DirectX 6 appears during the game installation. At the end of installation, you are prompted to register Luftwaffe Commander electronically. For network play, you need a DirectPlay compatible network adapter.

Installing the Game

You must install Luftwaffe Commander game files to your hard drive and have the Luftwaffe Commander CD in your CD-ROM drive to play this game.

To install the game, insert the CD into the CD-ROM drive. When the pop-up window appears, click on the Install option. If you have disabled the Windows 95 Autorun, or if it does not function, Explore the CD and double-click on the Setup icon. Follow all on-screen prompts to complete the installation.

Starting the Game

The Luftwaffe Commander Autorun program displays a menu with the options to run the game, Install DirectX, Uninstall the game, or view the README.TXT file, every time the CD-ROM drive is closed with the CD in place. Luftwaffe Commander can also be started by opening the Start menu, selecting Programs and choosing the folder where Luftwaffe Commander was installed and double-clicking on the Luftwaffe Commander program item. The other item in that folder is the Scenario Builder program which can be used to create or edit scenarios on your own.

For complete and specific "how to play" information, please refer to the rest of the manual. Some changes were made too late to include in this manual. Please read the README.TXT file in your game directory for more information.

Uninstalling the Game

To uninstall the game, select that option from the Autorun menu, or choose Settings from the Windows 95 Start Button, and select Control Panel. In the Control Panel, select Add/Remove Programs, left-click on LUFTWAFFE COMMANDER, and click on the Add/Remove button. The game and all of its components are then removed from your hard drive, except for your saved games or edited scenarios.

Saving Games

LUFTWAFFE COMMANDER requires space on your hard drive for Saved Games and temporary files. Each saved game can take up to 300kb of hard drive space. Note: If you exchange a saved game with someone, it is important to note which slot it occupied since it can only be played from that position in the save game list.

Electronic Registration

If you did not register your copy of LUFTWAFFE COMMANDER after installation and wish to do so later:

1. From your desktop select the Start button, click on Programs, click on LUFTWAFFE COMMANDER and click on Electronic Registration.
2. Follow all on screen prompts.

■ TROUBLESHOOTING

This section provides information that

Sound and Video Cards

Some sound and/or video cards are not
do not have one of the following Sound

DirectX Supported Sound Cards: Aztech

DirectX Supported Video Cards: ATI,
Tseng Labs, Western Digital, 3Dlabs,

DirectX 6 Setup

This game requires DirectX 6. If you
reinstalled from the CD. Installing
can also be installed by exploring the
Double click on DXSETUP.EXE to start

Using either the Install DirectX 6
install DirectX 6, reinstall DirectX 6,
previous audio and video driver as

DirectX Disclaimer

LUFTWAFFE COMMANDER utilizes
a programming tool created by
video problems and system anomalies
DirectX compliant. DirectX is a
sible for changes that might occur to
DirectX related problems that cannot
Windows 95 or 98 driver set, you
of your video card for further

Microsoft retains all intellectual
a limited license to use DirectX with

Verifying DirectX Video/Sound

To verify that your sound and video

1. Click on the windows Start
2. Click on Run.
3. In the open field type the
   OK. Click on the DirectX Drivers
4. Make sure all drivers say "Yes"

If any of your drivers are not
manufacturer and see if they have

lease refer to the rest of the
this manual. Please read the
nation.

un menu, or choose Settings
Panel. In the Control Panel,
OMMANDER, and click on the
are then removed from your
ios.

or Saved Games and tempo-
rd drive space. Note: If you
note which slot it occupied
game list.

fter installation and wish to

ograms, click on LUFTWAFFE

■ TROUBLESHOOTING

This section provides information that should help you solve some common problems.

Sound and Video Cards

Some sound and/or video cards are not supported by Windows 95 and DirectX. If you do not have one of the following Sound or Video cards, the game may not work.

DirectX Supported Sound Cards: Aztech, Creative Labs, ESS, Microsoft

DirectX Supported Video Cards: ATI, Chips @ Technologies, Cirrus Logic, Matrox, S3, Tseng Labs, Western Digital, 3Dlabs, Creative Labs, Rendition

DirectX 6 Setup

This game requires DirectX 6. If you do not have DirectX 6, then it can be installed or reinstalled from the CD. Installing DirectX 6 is an option when installing the game. It can also be installed by exploring the game CD, and opening the DIRECTX folder. Double click on DXSETUP.EXE to start the DirectX 6 install.

Using either the Install DirectX 6 button from the Autorun or DXSETUP.EXE, you can install DirectX 6, reinstall DirectX 6, test your drivers certification, or reinstate your previous audio and video driver as described following.

DirectX Disclaimer

LUFTWAFFE COMMANDER utilizes Microsoft's DirectX sound and video drivers. DirectX is a programming tool created by Microsoft, and the installation of DirectX may cause video problems and system anomalies with computers using video drivers that aren't DirectX compliant. DirectX is a Microsoft product, and as such, SSI cannot be responsible for changes that might occur to your computer system due to its installation. For DirectX related problems that cannot be fixed by updating to your video card's latest Windows 95 or 98 driver set, you must contact either Microsoft or the manufacturer of your video card for further technical support or service.

Microsoft retains all intellectual property rights to DirectX. The user has been granted a limited license to use DirectX with Microsoft operating system products.

Verifying DirectX Video/Sound Card Drivers

To verify that your sound and video drivers are DirectX 6 certified, follow these steps:

1. Click on the windows Start button (usually in the lower-left corner of your screen).
2. Click on Run.
3. In the open field type the command: C:\progra~1\directx\dxdiag.exe then click on OK. Click on the DirectX Drivers tab.
4. Make sure all drivers say "Yes" in the Certified column.

If any of your drivers are not DirectX certified you should contact the hardware manufacturer and see if they have certified DirectX 6 drivers.

Reinstating Windows 95 Video Drivers

If you find that there is a problem with your display after you have installed DirectX 6 you can reinstate your old video drivers by following the instructions below.

1. Click on the windows Start button (usually in the lower-left corner of your screen).
2. Click on Run.
3. In the open field type the command: C:\progra~1\directx\dxsetup.exe then click on OK.
4. Click on the Restore Display Drivers button.

This may require that you have the disk containing your original drivers.

Contacting SSI Technical Support

If you are having problems, please consult the Troubleshooting section of this manual before contacting SSI Technical Support. We've put many of the solutions to the most common problems in this area. If you are sure that you meet the LUFTWAFFE COMMANDER system requirements and the game still does not run, please make certain that you are using the latest drivers for your system.

We have a staff of Technical Support Specialists ready to help you with any technical problems you may have with any of our games. If your problem is due to your system configuration they can suggest some possible solutions. Because of the millions of different hardware and software configurations possible with today's PCs, you may still have to consult with your computer dealer, hardware manufacturer, or software publisher to properly configure your system before our game will work. You may also need to get the latest version of your sound, video, mouse, or CD-ROM drivers for the game to run properly.

We suggest contacting SSI Technical Support via fax or e-mail if possible. Please send a printout of your c:\autoexec.bat file, a printout of your c:\config.sys file, and a complete description of the problem. Please include the operating system you are using, and any error messages you have seen which indicate that there is a problem. Please send this information to our fax number, or the e-mail address found below.

Fax: (423) 670-2021 Attn: SSI Technical Support
E-mail: support@learningco.com

If you cannot fax or e-mail us, we can also be reached by phone. Our Technical Support number is (423) 670-2020 between 9:00 A.M. and 9:00 P.M., Eastern Standard Time, Monday through Friday, holidays excluded. **Absolutely no game playing hints are given through this number.**

SSI Online

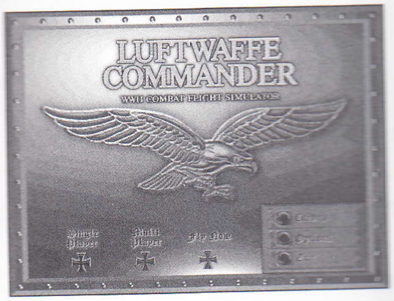
If the game about which you are inquiring has been out for more than 90 days, you'll also want to visit our website to be sure you are running the latest version of the game before contacting SSI Technical Support. The SSI website is located at www.ssionline.com. From time to time, additional scenarios and maps may also be posted to this website.

Copy Protection

In order to play LUFTWAFFE COMMANDER, the game CD must be in the CD-ROM drive.

■ SECTION 1 - MENUS

Main Menu



Navigation Buttons

In the lower right corner on all of the
selecting various options within the

Credits which displays the people who

Options a screen where various
see the "Options Screens" section,

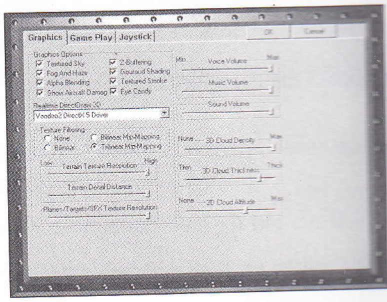
Exit quits the game and exits to the

Options Screens

Left-clicking on the option button
pages of option settings. Each page
Game Play, and Joystick controls. Each set
tions following.

Once you have made the appropriate
button saves your configuration and
button cancels all changes and returns

Graphics



☑ Textured Sky
☑ Fog And Haze
☑ Alpha Blending
☑ Show Aircraft Damag
☑ Z-Buffering
☑ Gouraud Shading
☑ Textured Smoke
☑ Eye Candy
Realtime DirectDraw 3D: Voodoo2 DirectX 5 Driver
○ None
○ Bilinear
○ Bilinear Mip-Mapping
● Trilinear Mip-Mapping

after you have installed DirectX 6
the instructions below.

lower-left corner of your screen).

-1\directx\dxsetup.exe then click

our original drivers.

eshooting section of this manual
any of the solutions to the most
u meet the LUFTWAFFE COMMANDER
please make certain that you are

help you with any technical prob-
lem is due to your system config-
e of the millions of different hard-
PCs, you may still have to consult
r software publisher to properly
ay also need to get the latest ver-
r the game to run properly.

r e-mail if possible. Please send
ur c:\config.sys file, and a com-
perating system you are using,
that there is a problem. Please
address found below.

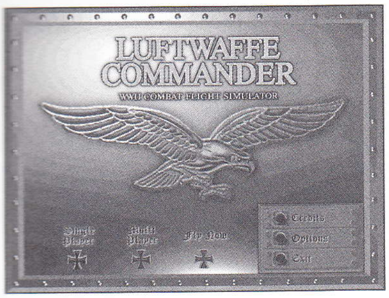
y phone. Our Technical Support
0 P.M., Eastern Standard Time,
y no game playing hints are

r more than 90 days, you'll also
atest version of the game before
ed at www.ssionline.com. From
posted to this website.

ust be in the CD-ROM drive.

■ SECTION 1 - MENUS

Main Menu



The Main Menu is where you select one of three ways to fly: Single Player where you fly alone or in command of a **rotte**, of fighters (a two fighter combat element), Multi Player where you and your rotte duel other pilots and Schwarms over the internet, by modem, or across a local area network (LAN), and Fly Now which allows you to just jump into the cockpit of a Bf-109 and fly! Any of these can be selected by moving the cursor over the appropriate icon and left-clicking.

Navigation Buttons

In the lower right corner on all of the menu screens are buttons for navigating and selecting various options within the game. On the Main menu these are:

Credits which displays the people who brought you LUFTWAFFE COMMANDER.

Options a screen where various "look-and-feel" options are set. For more information see the "Options Screens" section, below.

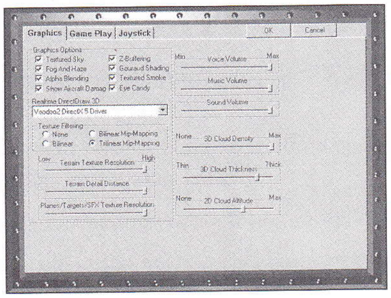
Exit quits the game and exits to the desktop.

Options Screens

Left-clicking on the option button displays the Options screen which is actually three pages of option settings. Each page can be selected using the following tabs: Graphic, Game Play, and Joystick controls. Each set of options are described in the appropriate sections following.

Once you have made the appropriate adjustments on each page, left-clicking on the OK button saves your configuration and returns you to the menu you came from. The Cancel button cancels all changes and returns you to the menu you came from.

Graphics



Graphics Options
☑ Textured Sky
☑ Fog And Haze
☑ Alpha Blending
☑ Show Aircraft Damag
☑ Z-Buffering
☑ Gouraud Shading
☑ Textured Smoke
☑ Eye Candy

Realtime DirectDraw 3D
Voodoo2 DirectX 5 Driver

Texture Filtering
○ None
○ Bilinear
○ Bilinear Mip-Mapping
● Trilinear Mip-Mapping

Textured Sky — Draw a textured sky as opposed to a single colored sky.

Fog and Haze — Use fog to smooth out color differences between sky and land.

Alpha Blending — Draw scene with varying levels of transparency.

Textured smoke — Draw textured smoke as opposed to polygonal cylinders of smoke.

Realtime DirectDraw 3D — Which 3D hardware accelerator present in the computer is used for rendering. Use the pull-down menu to select an option. It may be necessary to experiment with the various options until you find the one that delivers the best performance on your system.

Texture Filtering

- None — No manipulation of texture maps.
- Bilinear — Average edges of texture maps to make them appear less blocky at close range.
- Bilinear Mip-Mapping — use prefiltered texture maps of varying resolutions for level-of-detail smoothing.
- Trilinear Mip-Mapping — use prefiltered texture maps from bilinear filtering, and average them together for seamless transition from one texture maps level of detail to the next texture map level of detail.

Terrain Texture Resolution — This slider control adjusts the size of the land texture maps based on the amount of texture memory available on the 3D hardware card. The higher the slider, the more texture memory land textures will use. The lower the slider, the less texture memory the land will use, but land textures will appear more blocky.

Planes/Targets/SFX Texture Resolution — Adjust the size of the texture maps used for airplanes, targets, and special effects based on the amount of texture memory available on 3D hardware card. The higher the slider, the more video memory these textures will use. The lower the slider, the less texture memory these textures will use, but the textures on these objects will appear more blocky. NOTE: A good solution for most 4 megabyte video cards with mip-mapping enabled is to set the land texture map slider to one less than full resolution, and leave the Planes/Targets/SFX Texture resolution at full resolution (all the way to the right).

Voice Volume — loudness setting of voices

Music Volume — loudness setting of music

Sound Volume — loudness setting of sounds

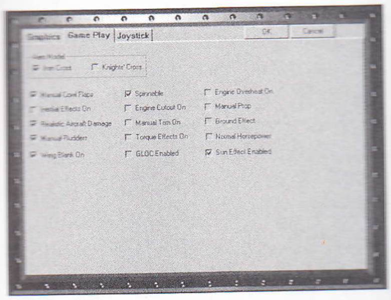
3D Cloud Density — number of 3D clouds in a 40 mile square

3D Cloud Thickness — height of 3D clouds

2D Cloud Altitude — altitude of the cloud layer

Note: Higher settings on game detail options may cause the game to run more slowly on some machines.

Gameplay



Flight Model
☑ Iron Cross ☐ Knights' Cross

☑ Manual Cowl Flaps
☐ Inertial Effects On
☑ Realistic Aircraft Damage
☑ Manual Rudders
☑ Wing Blank On
☑ Spinnable
☐ Engine Cutout On
☐ Manual Trim On
☐ Torque Effects On
☐ GLOC Enabled
☐ Engine Overheat On
☐ Manual Prop
☐ Ground Effect
☐ Normal Horsepower
☑ Sun Effect Enabled

Manual Cowl Flaps — User operated cow

Inertial Effects On — Pitch, roll and yaw ine

Realistic Aircraft Damage — Allows real

Manual Rudders — If the user has rudd
select manual rudders to control the rud

Wing Blank On — Turn on the effect of th
airplane has sideslip angle.

Spinnable — If checked, aircraft will ent
time of a stall.

Engine Cutout On — If checked, non-fuel
during negative-G maneuvers.

Manual Trim On — If checked, user cont
keys; [+] is nose up trim, and [-] is nose d

Torque Effects On — If checked, the Ang
aircraft are used to calculate the left-turn

GLOC Enabled — Allow G-induced los
pulling positive Gs and redout when pul

Engine Overheat On — Allows engine da
engine overheat can **always** occur from

Manual Prop — Allows you to control t
stant speed engines.

Ground Effect — If checked, turns on the
during takeoff and landing.

Normal Horsepower — If not checked, t

Sun Effect Enabled — This option allow

ccelerator present in the computer
lect an option. It may be necessary
l the one that delivers the best per-

make them appear less blocky at

re maps of varying resolutions for

e maps from bilinear filtering, and
n from one texture maps level of

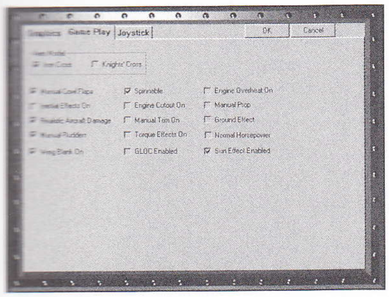
djusts the size of the land texture
ble on the 3D hardware card. The
tures will use. The lower the slid-
l textures will appear more blocky.

e size of the texture maps used for
amount of texture memory avail-
he more video memory these tex-
e memory these textures will use,
locky. NOTE: A good solution for
bled is to set the land texture map
Planes/Targets/SFX Texture reso-

square

se the game to run more slowly

Gameplay



Aero Model
☑ Iron Cross ☐ Knights' Cross

☑ Manual Cowl Flaps
☐ Inertial Effects On
☑ Realistic Aircraft Damage
☑ Manual Rudders
☑ Wing Blank On
☑ Spinnable
☐ Engine Cutout On
☐ Manual Trim On
☐ Torque Effects On
☐ GLOC Enabled
☐ Engine Overheat On
☐ Manual Prop
☐ Ground Effect
☐ Normal Horsepower
☑ Sun Effect Enabled

Aero model

Iron Cross - Relaxed flying characteristics, with each item selectable by the user; turning on all effects is the same as flying at the Knights' Cross level.

Knights Cross - "Realistic" flying characteristics, this model does not let you select individual components to turn on and off. See the "Iron Cross/Knight's Cross Aero Models" section on page 29 for more information.

Manual Cowl Flaps — User operated cowl flaps to control engine cooling.

Inertial Effects On — Pitch, roll and yaw inertia are included in the aerodynamic equations.

Realistic Aircraft Damage — Allows realistic collision detection.

Manual Rudders — If the user has rudder pedals, or a joystick with a rudder input, select manual rudders to control the rudder of the airplane.

Wing Blank On — Turn on the effect of the fuselage blocking airflow over a wing if the airplane has sideslip angle.

Spinnable — If checked, aircraft will enter a spin if controls are uncoordinated at the time of a stall.

Engine Cutout On — If checked, non-fuel injected aircraft engines will begin to sputter during negative-G maneuvers.

Manual Trim On — If checked, user controls aircraft pitch trim with the Keypad [+]/[-] keys; [+] is nose up trim, and [-] is nose down trim.

Torque Effects On — If checked, the Angle of Attack, Power Setting, and Speed of the aircraft are used to calculate the left-turning tendencies of the aircraft.

GLOC Enabled — Allow G-induced loss of consciousness to cause blackout when pulling positive Gs and redout when pulling negative Gs.

Engine Overheat On — Allows engine damage from overheating due to poor operation, engine overheat can **always** occur from damage due to bullets.

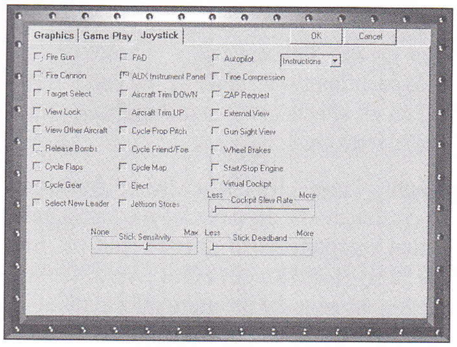
Manual Prop — Allows you to control the pitch of the propeller in aircraft with constant speed engines.

Ground Effect — If checked, turns on the effect of the ground in reducing induced drag during takeoff and landing.

Normal Horsepower — If not checked, the engine is modeled with extra horsepower.

Sun Effect Enabled — This option allows white-out from looking at the sun.

Joystick



To alter your joystick settings, click in the box next to the setting to be changed, and then press the button on your joystick that you want to represent that function. For example, if your joystick has two buttons on the stick that you can press with your thumb and you want one of them to toggle the Virtual Cockpit option on and off. First, left-click in the check box for Virtual Cockpit, then push the button to be used.

Once a joystick button has been assigned, the option can only be re-assigned, not cleared. To reassign a function, click on an unassigned function and press the button you wish to assign it to. The previous function can be assigned to a new button now using the same procedure. The possible functions and their keyboard equivalent are:

FUNCTION	OPERATION	KEYBOARD SETTING
Fire Gun	fire machine guns	Spacebar
Fire Cannon	fire cannon	C
Target Select	select target	T
View Lock	target track view	V
View Other Aircraft	view other aircraft	O
Release Bombs	release bombs	Backspace
Cycle Flaps	raise/lower flaps	F
Cycle Gear	raise/lower gear	G
Select New Leader	select new leader	Y
FAD	formation augmentation device	Shift + F
AUX Instrument Panel	auxiliary instrument panel	F2
Aircraft Trim DOWN	aircraft trim down	Numpad −
Aircraft Trim UP	aircraft trim up	Numpad +
Cycle Prop Pitch	climb/cruise/descent prop pitch setting	U
Cycle Friend/Foe	cycle GCI between friend and foe	I
Cycle Map	cycle between map and cockpit views	M
Eject	eject from airborne aircraft	Shift + E
Jettison Stores/Drop Bomb	jettison stores/drop bomb	Shift + J, J
Autopilot	cycle autopilot	A
Time Compression	cycle time compression	Shift + T
ZAP Request	request next action point	Z
External View	external view of own ship	F3
Gun Sight View	gunsight only; remove cockpit	F4
Wheel Brakes	cycle wheel brakes	B
Start/Stop Engine	cycle engine	W
Virtual Cockpit	3D cockpit	End

Cockpit Slew Rate — Adjusts rate at which the "coolie hat" switch turns the point of view in the virtual cockpit.

Stick Sensitivity — This slider adjusts the joystick sensitivity.

Stick Deadband — Joystick deadband adjusts the amount of distance that the joystick actually moves before the flight of your aircraft is affected. The higher the "deadband" setting, the farther from center the stick must move before something happens.

Single Player

Campaigns

Selecting this option opens the Campaig
Campaign game is started, saved, or resto
this page for more information.

Single Mission

Each campaign mission may be flown in
Each of the five different fronts, Spain, Fra
unique missions to choose from. See the "
for more information.

Air Combat

Using the Air Combat menu, a skirmish betw
choose, can take on up to six opponents o
starting on page 14 for more information.

Aircraft Familiarization

The Aircraft Familiarization screens display ea
ettes, and other vital data. In addition,
LUFTWAFFE COMMANDER can be taken for a
section, starting on page 13 for more info

Campaign Menus

Once the campaign option has been select
Cross or Knights Cross, must be chosen. Move
left-click in order to make your selection.
of a challenge from a combat perspective
simplified to a level similar to earlier, sim
would swear you are flying a real, WWII
as cowl-flaps and propeller pitch, while
airframe stress.

Note: If the full-blown Knight's Cross aero m
ious options that combine to make it up
menu screen.

r your joystick settings, click
box next to the setting to be
d, and then press the button
r joystick that you want to
nt that function. For exam-
our joystick has two buttons
stick that you can press with
umb and you want one of
toggle the Virtual Cockpit option
off. First, left-click in the
ox for Virtual Cockpit, then push
on to be used.

an only be re-assigned, not
unction and press the button
signed to a new button now
eir keyboard equivalent are:

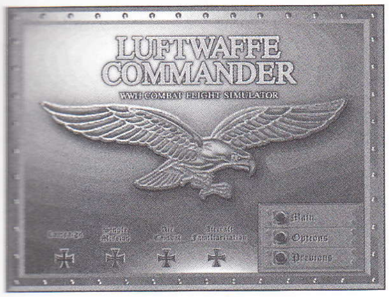
ARD SETTING

" switch turns the point of

ty.

f distance that the joystick
he higher the "deadband"
something happens.

Single Player



The Single Player Menu is where you select one of four options: play a Campaign, fly a Single Mission, create an Air Combat session, or view the Aircraft Familiarization screen. Any one of these can be selected by left-clicking on its icon.

The Navigation panel has buttons to return to the Main menu screen, open the Options screen, or return to the Previous screen. These are the navigation buttons visible on most of the menu screens to follow.

Campaigns

Selecting this option opens the Campaign Menu where pilots are created and the Campaign game is started, saved, or restored. See the "Campaign Menus" section on this page for more information.

Single Mission

Each campaign mission may be flown individually by using the Single Mission menu. Each of the five different fronts, Spain, France, Britain, Russia, and Germany have ten unique missions to choose from. See the "Single Mission" section, starting on page 14 for more information.

Air Combat

Using the Air Combat menu, a skirmish between your pilot, aided by a wingman if you choose, can take on up to six opponents of varying skill. See the "Air Combat" section, starting on page 14 for more information.

Aircraft Familiarization

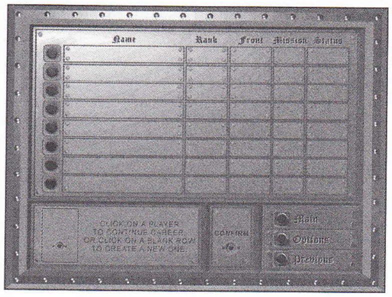
The Aircraft Familiarization screens display each plane's characteristic markings, silhouettes, and other vital data. In addition, each of the planes that can be flown in LUFTWAFFE COMMANDER can be taken for a test flight. See the "Aircraft Familiarization" section, starting on page 13 for more information.

Campaign Menus

Once the campaign option has been selected, the selection of aero model, either the Iron Cross or Knights Cross, must be chosen. Move the cursor over one of the two symbols and left-click in order to make your selection. The Iron Cross level aero model offers no less of a challenge from a combat perspective, however, the process of flying the plane is simplified to a level similar to earlier, simpler simulations. At the Knight's Cross level, you would swear you are flying a real, WWII fighter. You control such flight variables such as cowl-flaps and propeller pitch, while dealing with a realistic model of inertia and airframe stress.

Note: If the full-blown Knight's Cross aero model is beyond your capability at first, the various options that combine to make it up can be activated selectively using the Options menu screen.

Pilot Selection

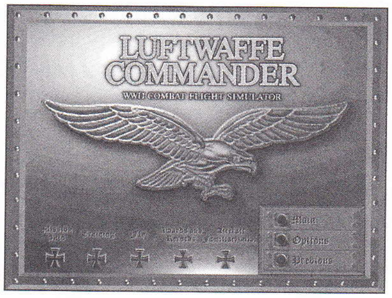


CLICK ON A PLAYER TO CONTINUE CAREER OR CLICK ON A BLANK ROW TO CREATE A NEW ONE.

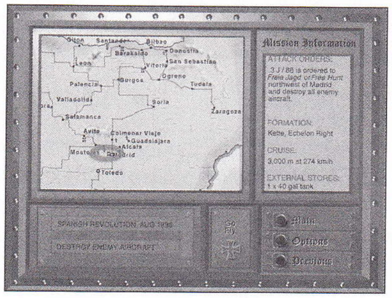
Once Iron Cross or Knight's Cross has been selected you must either create a new pilot or select an existing pilot. In order to create a new pilot, click on a blank row and type in a name of up to fourteen characters. Use the Backspace to erase characters and the Spacebar for skipping spaces. Press Enter when finished. Your current rank, front, mission, and status are displayed.

To fly missions with one of your pilots, left-click to select the pilot, then left-click on the Confirm button to proceed to the Campaign Menu screen. Up to eight pilots can be active in the campaign game. To delete a pilot simply click on the pilot's name and confirm the deletion using the Remove Player button. **Note**: Once a pilot has been deleted you can no longer be able to view the record, it is gone forever.

Main Campaign Menu



The main campaign menu has the following buttons: Mission Information, Training, Fly, Awards/Records, and Aircraft Familiarization, in addition to the navigation buttons Main, Options and Previous. Left-click to select one of these and proceed to the appropriate screen



ATTACK ORDERS:
3.J / 88 is ordered to *Freie Jagd* or *Free Hunt* northwest of Madrid and destroy all enemy aircraft.

FORMATION:
Kette, Echelon Right

CRUISE:
3,000 m at 274 km/h

EXTERNAL STORES:
1 x 40 gal tank

SPANISH REVOLUTION, AUG 1936
DESTROY ENEMY AIRCRAFT

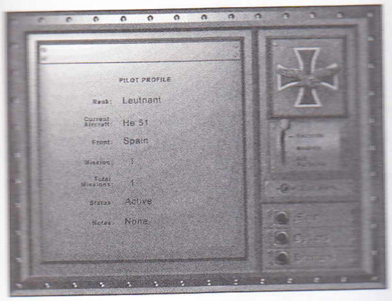
Mission Information — Mission information details objectives for that pilot's current mission and displays course information on the map. In some cases there is no required course, the pilot is permitted to hunt freely, or "freie jagd."

Training — Training is designed to give the new pilot a basic understanding of flight through the use of basic instruments in a scenario designed to evaluate the pilot in take-off and landing techniques. Once this has been accomplished the pilot is awarded a pilot's badge. **Note**: Any death while training in the Knight's Cross campaign terminates that career.

A flight instructor is present during the training mission to talk the pilot through the course of flight and describe the controls necessary for flight maneuvers.

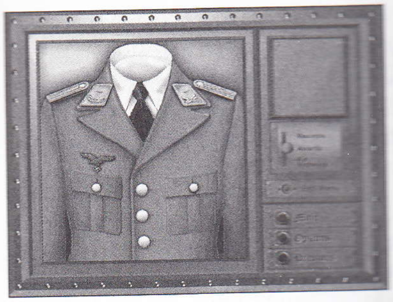
Fly

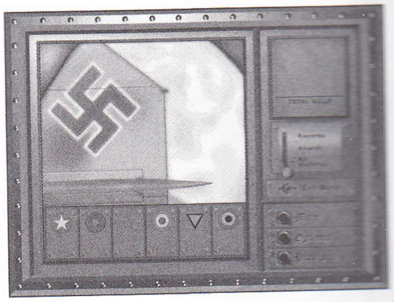
Left-click on the Fly button whenever you



PILOT PROFILE
Rank: Leutnant
Current Aircraft: He 51
Front: Spain
Mission: 1
Total Missions: 1
Status: Active
Notes: None

The lever on the right side of the scree
Awards and Air Victories screens.





Cross or Knight's Cross has been select-
must either create a new pilot or
existing pilot. In order to create a
t, click on a blank row and type in
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for skipping spaces. Press Enter
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Mission Information, Training, Fly,
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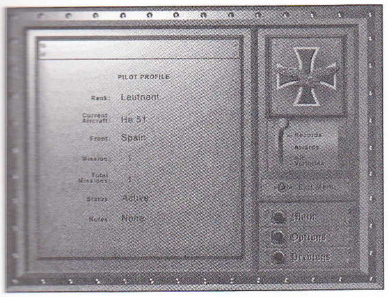
a basic understanding of flight
use of basic instruments in a sce-
ned to evaluate the pilot in take-off
hed the pilot is awarded a pilot's
campaign terminates that career.
ion to talk the pilot through the
r flight maneuvers.

Fly

Left-click on the Fly button whenever you are ready to fly the next mission.



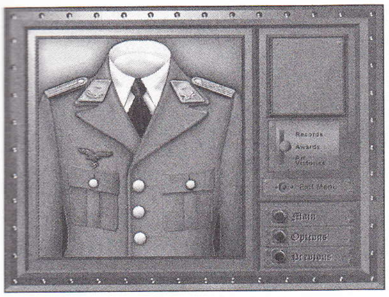
PILOT PROFILE

Rank: Leutnant
Current Aircraft: He 51
Front: Spain
Mission: 1
Total Missions: 1
Status: Active
Notes: None

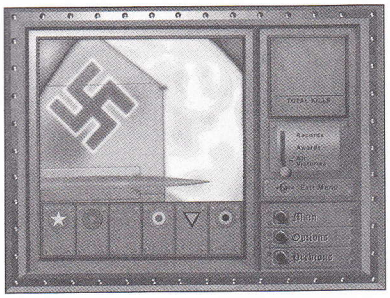
Mission Awards and Records

Once selected, the Pilot Profile appears displaying: current Rank, current Aircraft type, current Front, Mission number, Total Missions flown, and current Status. Any reprimands are listed under Notes Note: After three reprimands a pilot's career is terminated.

The lever on the right side of the screen allow two other screens to be displayed, the Awards and Air Victories screens.

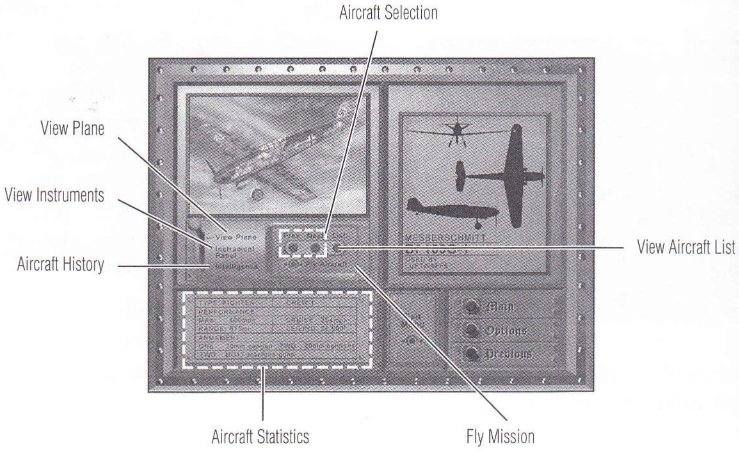


By clicking on Awards the display changes to your pilot's uniform, with current awards shown on it. See Appendix A for a full list of possible awards.



Current air victories may be viewed by selecting Air Victories. Air victories are broken down and displayed by the country that was operating the aircraft you shot down.

Aircraft Familiarization



These series of screens may be used to obtain additional information on all the aircraft covered in this game. This screen displays a view of each type of plane, next to a recognition silhouette. Below the photo is a lever which presents information such as instrument panel descriptions and audio intelligence information for the aircraft that you are permitted to fly. Select which option you wish to view by left-clicking on the text next to the lever.

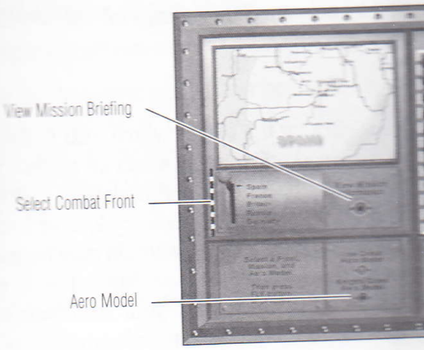
The Prev and Next buttons cycle through all the aircraft in the game at the setting the lever is at. Standard data such as speed, armament, and range are available on every aircraft in the game and are displayed in the lower left-hand corner. The View Plane setting is recommended for this purpose, since only the planes that can be flown have Instrument Panel or Intelligence displays. Those planes are:

He-51	Bf-109D
Bf-109E	Bf-109F
Bf-109G	Me-262
I-16	Spitfire MK1
P-5ID	P-39Q

Note: These aircraft listed may be flown from this page by pressing the Fly Aircraft button. This is not a campaign mission, rather more of a check out flight.

Left-clicking on the List button displays a screen with the list of all the aircraft in LUFTWAFFE COMMANDER. Once the list is displayed any aircraft may be selected for familiarization information. The ten planes that can be flown in LUFTWAFFE COMMANDER are displayed in the upper-left corner. The Exit Menu button restores the Familiarization screen.

Single Mission

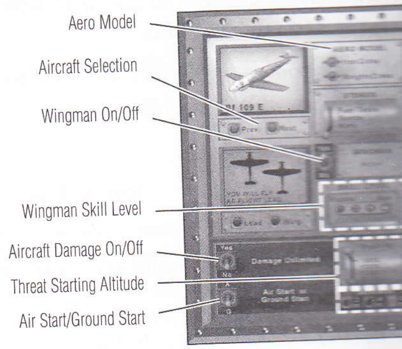


Each campaign mission may be flown
France, Britain, Russia, and Germany have
front by left-clicking on the lever below the
at this time; we recommend the Iron Cross for
be flown followed by the Mission Information
Mission Information screen, the Previous button
starts the mission. you can also fly directly

Air Combat

The Air Combat screen allows you, and one
enemy aircraft flown by the computer AI,
can determine which fighter your pilot and
skill levels of the computer pilots, starting
planes start grounded or airborne.

Configure the Aircraft



First, use the Prev or Next buttons to
choose the Iron Cross or Knight's Cross aero
selected, you must then decide whether

information on all the aircraft
type of plane, next to a recog-
ts information such as instru-
on for the aircraft that you are
eft-clicking on the text next to

n the game at the setting the
range are available on every
and corner. The View Plane set-
anes that can be flown have

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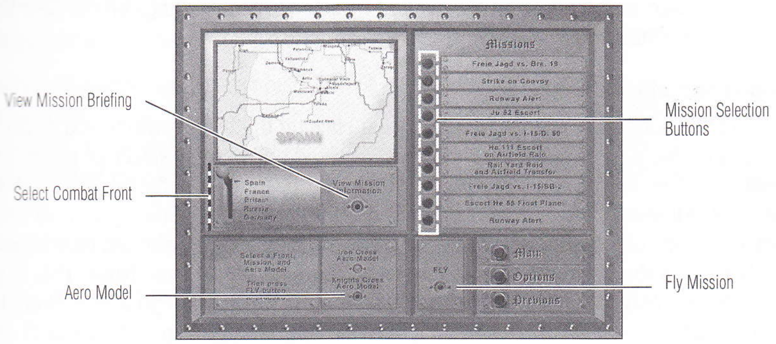
the Familiarization screen.

Single Mission

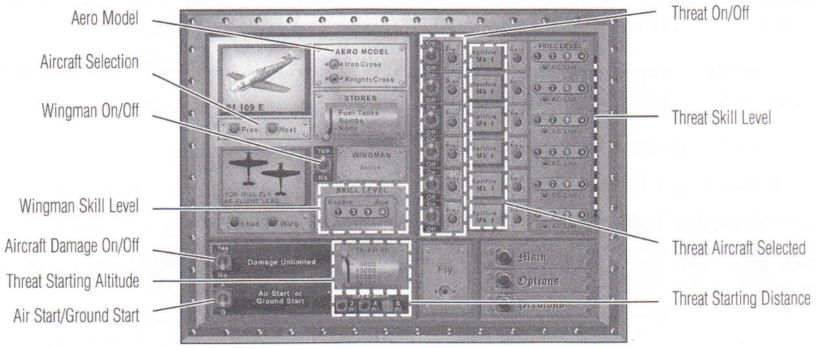


Each campaign mission may be flown individually. Each of the five different fronts, Spain, France, Britain, Russia, and Germany have ten unique missions to choose from. Select the front by left-clicking on the lever below the map display. An aero model may be selected at this time; we recommend the Iron Cross for beginners. Then left-click on the mission to be flown followed by the Mission Information button to view the mission briefing. From the Mission Information screen, the Previous button restores the Missions screen and the Go Fly button starts the mission. you can also fly directly from the Missions screen using the Fly button.

Air Combat

The Air Combat screen allows you, and one other aircraft if desired, to fight up to six enemy aircraft flown by the computer AI, in a single mission of your own design. You can determine which fighter your pilot and wingman fly, the number of opponents, the skill levels of the computer pilots, starting altitude, starting distance, and whether your planes start grounded or airborne.

Configure the Aircraft



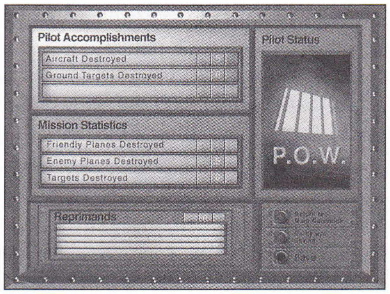
First, use the Prev or Next buttons to select the aircraft type. There are also buttons to choose the Iron Cross or Knight's Cross aero model. If more than a single friendly aircraft is selected, you must then decide whether you are the lead or wingman with the Wingman

Active toggle switch and how good a pilot they are using the Skill Level buttons. The aircraft may have unlimited damage by selecting Yes or No with the Damage Unlimited toggle and you may start in the air or on the ground by selecting the settings on the Air or Ground Start Panel. **Note**: Enemy aircraft always start in the air.

Configure the Threat Aircraft

First select the number of enemy aircraft by left-clicking the toggle switch next to the aircraft name to the On or Off position. If a threat is turned on you may select an aircraft type by clicking on Prev, Next or AC List button. Once this has been done, left-click on a skill level button 1 – 4. All enemy aircraft start separated from your pilot's plane by 2, 4, or 6 miles by clicking on one of these buttons under Separation. Aircraft starting altitude may be selected by clicking on the desired height in feet using the Threat Altitude lever. **Note**: This is your starting altitude only if you have selected A or air start. Once all of your selections have been made, left-click on the Fly button to fly the mission. The mission ends when all of the enemy aircraft have been destroyed, or your plane lands, crashes, or the pilot bails out.

Debrief Pages



This screen varies depending on whether you were flying a single mission or competing in an Iron Cross or Knight's Cross campaign.

Pilot Accomplishments

The large window to the right displays the pilot's status. Killed in action (KIA), prisoner of war (POW), rescued, or completed mission. In the case of a single mission, an Iron Cross second or first class, or Knight's Cross is awarded for 5, 10, or 15 air victories. If the debrief is for a campaign mission, "Award" is displayed if an award or promotion was earned during that mission.

Mission Statistics — Total friendly aircraft destroyed as well as enemy aircraft and ground targets are displayed. The pilot's status appears in panel on the right, whether Killed in Action (KIA), taken prisoner (POW), rescued, or successful.

Reprimands — Reprimands are displayed at the bottom of the screen. They are issued to your pilots for the following reasons:

- Shooting down a friendly aircraft
- Destroying a friendly ground target
- Ditching or bailing out of an undamaged aircraft

Each pilot may only have three total reprimands, the fourth reprimand ends that pilot's career.

Save Options — There are no save options in single mission play. In the Knight's Cross campaign all missions are saved. In an Iron Cross Campaign you may choose to Save, Re-fly w/o Saving, or Return to the Main Campaign menu unless you have been killed, have been made a POW, or have collected your fourth reprimand.

■ SECTION 2 - MULTI-PLAYER M

Multi-Player Main Menu

Multiplayer allows several players to fly

Once the Multiplayer option has been mad
screen is displayed. Using the mouse on
Modem/Serial, or Network Melee. Depending
choice of connection type must be mad
dow: Internet TCP/IP, IPX Connection, Modem C

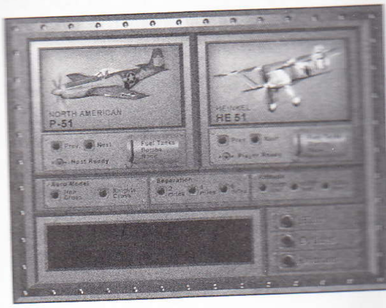
Internet TCP/IP is used for Online and s

IPX Connection is used when playing a

Modem Connection is used to play usin

Serial Connection is used to play using

Modem / Serial Host



The host then sets the other availabl

- Aero Model — Iron Cross or Knight's Cr
- Separation — 2 miles, 4 miles, or 6
- Starting Altitude — 3,000 feet, 6,0

The player choosing not to host ca
menu appears.

Modem Connect

Once the ready button has been cho
can be entered, or the modem configu
ber is entered in the dialog box, left-
puter. The host computer is placed in

Once connected, the battle begins a
shot down.

g the Skill Level buttons. The air-
o with the Damage Unlimited toggle.
ng the settings on the Air or Ground

the toggle switch next to the air-
n you may select an aircraft type
en done, left-click on a skill level
r pilot's plane by 2, 4, or 6 miles
t starting altitude may be select-
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Once all of your selections have
The mission ends when all of the
crashes, or the pilot bails out.

varies depending on whether
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successful.

f the screen. They are issued

fourth reprimand ends that

sion play. In the Knight's Cross
n you may choose to Save, Re-
have been killed, have been

SECTION 2 – MULTI-PLAYER MENUS

Multi-Player Main Menu

Multiplayer allows several players to fly together, or against one another.

Once the Multiplayer option has been made from the Main Menu screen, the Multiplayer screen is displayed. Using the mouse on this screen, you may left click and select Online, Modem/Serial, or Network Melee. Depending on which option you choose on this screen, a choice of connection type must be made. Four choices are displayed in a dialog window: Internet TCP/IP, IPX Connection, Modem Connection and Serial Connection.

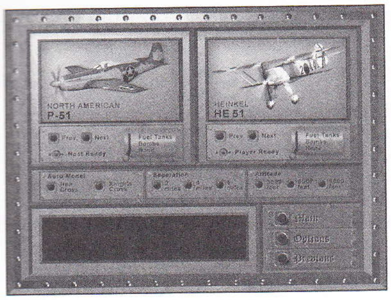
Internet TCP/IP is used for Online and some forms of Network play.

IPX Connection is used when playing across a Local Area Network (LAN).

Modem Connection is used to play using direct connect via modem.

Serial Connection is used to play using direct connect via null-modem serial cable.

Modem / Serial Host



Modem/Serial games are flown head-to-head, you against your opponent. When you select this kind of game, a screen appears which shows two aircraft. Use the Prev and Next buttons in either the Player or Host portion of the screen to choose a plane to fly, and select stores such as bombs and drop tanks.

The host then sets the other available options:

- Aero Model — Iron Cross or Knight's Cross.
- Separation — 2 miles, 4 miles, or 6 miles.
- Starting Altitude — 3,000 feet, 6,000 feet, or 9,000 feet.

The player choosing not to host can click on the Player Ready button and the Dial-up menu appears.

Modem Connect

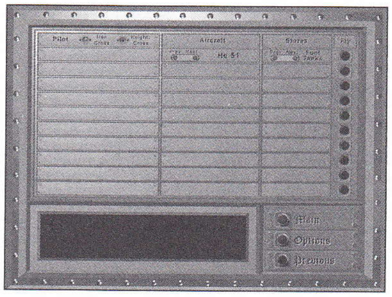
Once the ready button has been chosen, a dialog box appears where a phone number can be entered, or the modem configuration control panel can be displayed. Once a number is entered in the dialog box, left-clicking on the Connect button dials the other computer. The host computer is placed in answer mode when the Host Ready button is clicked.

Once connected, the battle begins and ends when either plane lands, crashes, or is shot down.

Network Melee

The Network Melee options allows up to ten players to fly head-to-head in any of the aircraft available in the game. After the Network Melee selection has been made, select a protocol such as TCP/IP or IPX in the dialog box that appears. Now, select Join or Host depending on whether you are hosting the game or merely playing in it. If you are hosting a game, a default name appears which can be changed by clicking in the text field, backspacing to delete the old name, and entering your choice of name in its place. Once this is done a dialog appears prompting you for a log-in; type up to six characters and press the Enter key.

Multiplayer Melee



Once connection has been made the con-figuration screen appears. Your log-on appears on one of the lines displayed in the first column, aircraft are selected in the second column. Other pilots appear on separate lines on the screen next to their aircraft choice.

Aerodynamic Model (Host Only)

The Host may select ether the Iron Cross (beginner), or Knight's Cross (advanced), or some variant using the Options menu. See the "Options Screen" section, starting on page 6 for more information.

Select Aircraft

You may select your aircraft with the Next or Prev button.

Stores Selection

You may select None, Bombs, or Fuel Tanks provided your aircraft is equipped to carry such external stores by pressing the Prev or Next buttons.

Fly

Enter the Melee area by clicking the Fly button. Other network players are in the area, already flying if the Fly button next to their name is illuminated. The mission ends when your pilot or his plane touches the ground, either by landing, crashing, or parachuting.

Network and On-line Chat

The large window at the bottom of the screen can be used to communicate with players logged into your game. Press the Home key during a multiplayer game to open the chat window. Pressing the / key sends any subsequent message only to "friendly" aircraft, while pressing the ? key sends the message to all players. Keyboard commands are disabled while the chat window is open, and the view is automatically restored to the F1 or forward view. Simply click in the window, and begin typing

SECTION 3 – KEYBOARD CONTRO

KEY	ACTION
Take Off/Landing	
b	Cycle wheel brakes
f	Cycle flaps up/down
w	Engine Ignition / Kill Switch
1	10% throttle
2	20% throttle
3	30% throttle
4	40% throttle
5	50% throttle
6	60% throttle
7	70% throttle
8	80% throttle
9	90% throttle
0	100% throttle
-	Decrease throttle
=	Increase throttle
g	Cycle raise/lower landing gea
Shift + G	Emergency landing gear activ
s	Skip to Take Off in Training
z	"Zap" to Take Off Position or
Flight Controls	
a	Cycle Auto pilot engage
Shift + C	Cycle cowl flaps
u	Cycle Prop between climb/c
↑	Pitch up
↓	Pitch down
→	Roll left
←	Roll right
Shift + E	Bailout activation
Shift + P	End bailout sequence
j	Release external stores
m	Cycle map/cockpit
r	Refuel own plane
Shift + R	Reload guns and/or cannon
p	Game paused
Shift + Q	Quit to menus
Shift + T	Cycles time compression
Numpad +	Manual increment trim No
Numpad -	Manual decrement trim No
Home	Chat Box
Enter	Center all controls
< + >	Manual rudder keys

e options allows up to ten
ad-to-head in any of the air-
n the game. After the Network
as been made, select a pro-
P/IP or IPX in the dialog box
Now, select Join or Host
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e Enter key.

has been made the con-figu-
pears. Your log-on appears
s displayed in the first col-
e selected in the second
ts appear on separate lines
t to their aircraft choice.

del (Host Only)

elect ether the Iron Cross
ght's Cross (advanced), or
g the Options menu. See the
nation.

is equipped to carry such

players are in the area,
. The mission ends when
rashing, or parachuting.

communicate with play-
player game to open the
ge only to "friendly" air-
rs. Keyboard commands
utomatically restored to
in typing

SECTION 3 – KEYBOARD CONTROLS

KEY	ACTION	TOGGLE(Y/N)
Take Off/Landing		
b	Cycle wheel brakes	Y
f	Cycle flaps up/down	Y
w	Engine Ignition / Kill Switch	Y
1	10% throttle	N
2	20% throttle	N
3	30% throttle	N
4	40% throttle	N
5	50% throttle	N
6	60% throttle	N
7	70% throttle	N
8	80% throttle	N
9	90% throttle	N
0	100% throttle	N
-	Decrease throttle	N
=	Increase throttle	N
g	Cycle raise/lower landing gear	Y
Shift + G	Emergency landing gear activation	N
s	Skip to Take Off in Training	N
z	"Zap" to Take Off Position or Designated Point	N
Flight Controls		
a	Cycle Auto pilot engage	Y
Shift + C	Cycle cowl flaps	Y
u	Cycle Prop between climb/cruise/descent	Y
↑	Pitch up	N
↓	Pitch down	N
→	Roll left	N
←	Roll right	N
Shift + E	Bailout activation	N
Shift + P	End bailout sequence	N
j	Release external stores	N
m	Cycle map/cockpit	Y
r	Refuel own plane	N
Shift + R	Reload guns and/or cannon rounds	N
p	Game paused	Y
Shift + Q	Quit to menus	N
Shift + T	Cycles time compression	Y
Numpad +	Manual increment trim Nose up trim	N
Numpad -	Manual decrement trim Nose trim down	N
Home	Chat Box	N
Enter	Center all controls	N
< + >	Manual rudder keys	N

Combat Controls

c	Fire cannon only	N
Spacebar	Fire machine guns only	N
Backspace	Bomb release	N
t	Cycle through targets	N
v	Target view lock	Y
o	Cycle through other aircraft	N
i	Cycle friend/foe on GCI	Y

View Controls

d	Side Panel (Spitfire, Me 262, P-39, p51, only)	N
Numpad 1	In-cockpit view left rear	N
Numpad 2	In-cockpit cycle from 45 deg up to horizontal to 90 deg up	N
Numpad 3	In-cockpit view right rear	N
Numpad 4	In-cockpit view left	N
Numpad 5	In-cockpit view main	N
Numpad 6	In-cockpit view right	N
Numpad 7	In-cockpit view left front	N
Numpad 8	In-cockpit view 45 deg up to 90 deg up to horizontal	N
Numpad 9	In-cockpit view right front	N
F1	Main cockpit view	N
F2	Full (Extended) Instrument Panel	N
F3	Tail / Chase view	N
F4	Gun sight only view	Y
Page Up	Zoom Out	N
Page Down	Zoom In	N
End	3D Cockpit toggle	Y

Flight Command Controls

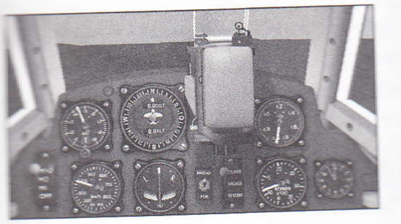
Esc	Exit to Windows	N
Shift + F	Cycle formation augmentation	Y
Shift + 3	Select left echelon formation	N
Shift + 4	Select right echelon formation	N
Shift + 5	Select trail formation	N
F9	Wingman command-form on me	N
F10	Wingman command-return to base	N
F11	Wingman command-cover me	N
F12	Wingman command-attack designated tgt	N
y	Select new flight lead	N

SECTION 4 - AIRCRAFT VIEWS

Cockpit Views

Cockpit views are broken down into two catego
inside the cockpit. All views may be accessed vi

Inside the Cockpit or Instrument Views



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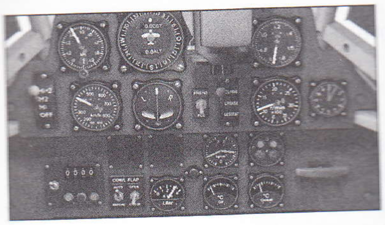
Auxiliary Instrument View



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Communications Panel

The lower right display or knee board view
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Map View

The map view, which in Iron Cross or single m
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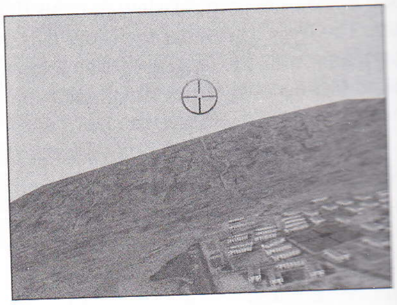
Gunsight Only View



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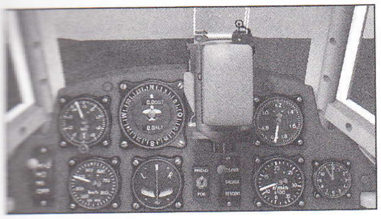
SECTION 4 - AIRCRAFT VIEWS

Cockpit Views

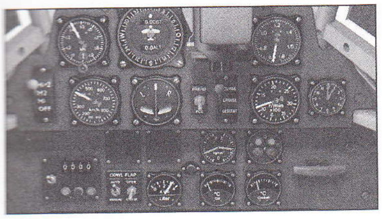
Cockpit views are broken down into two categories: Out of the cockpit or cruise views, and inside the cockpit. All views may be accessed via the keyboard or switch on a control stick.

Inside the Cockpit or Instrument Views



The basic instrument panel, may be accessed with F1 key. The basic instruments always contain the gunsight, altimeter, turn/bank indicator, compass/ground control instrument (GCI), and air speed indicator. Other instruments may appear based on space or historical layout.

Auxiliary Instrument View



The full instrument panel which includes the basic instruments plus the auxiliary instruments may be accessed with the F2 key. (Fig. 4-3) Instruments that appear on the auxilliary panel include fuel quantity gauges, oil pressure gauges, oil temperature gauges, and coolant gauges.

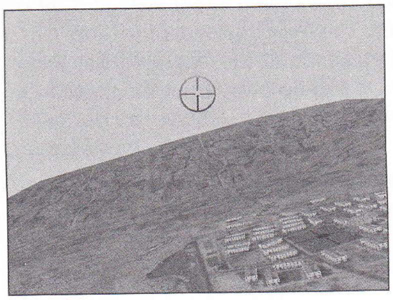
Communications Panel

The lower right display or knee board view may be accessed with Home key The view provides an area for communications with other players in the multi-player modes only.

Map View

The map view, which in Iron Cross or single mission includes an aircraft symbol of your current position and approximate heading, may be accessed by using the M key.

Gunsight Only View



The gunsight only view may be accessed by using the F4 key. The view will eliminate all of the instrumentation, as if you were moving your face up to the gun sight.

Inside the Cockpit Views

All cockpit views may be accessed by either the number pad (Fig. 4-6), or the "coolie-hat" switch located on your control stick (if available).

Looking Up

Pressing the `8` key, or moving the coolie-hat switch forward changes the view from the forward, level view to a forward, 45° up view. Pressing the `8` key, or moving the coolie-hat switch forward a second time changes the view to a 90° up view. Pressing the `8` key, or moving the coolie-hat switch forward a third time restores the forward, level view. Pressing the `2` key changes the view from the forward, level view to a 90° up view. The `8` and `2` keys can be used in this fashion to cycle the forward-45°-90° views back and forth.

Looking Left or Right

Pressing the `7` key, or moving the coolie-hat switch forward and left changes the view from the forward, level view to a forward, left view.

Pressing the `9` key, or moving the coolie-hat switch forward and right changes the view from the forward, level view to a forward, right view.

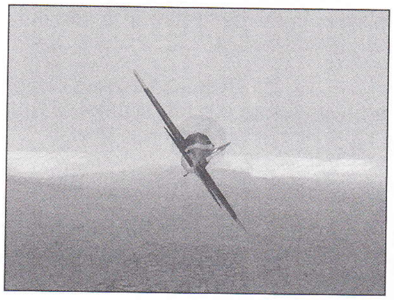
Pressing the `4` key, or moving the coolie-hat switch left changes the view from the forward, level view to a left view.

Pressing the `6` key, or moving the coolie-hat switch right changes the view from the forward, level view to a right view.

Looking Back

Pressing the `1` key, or moving the coolie-hat switch backwards changes the view from the forward, level view to a left, rear view. Pressing the `3` key, or moving the coolie-hat switch right changes the view from the forward, level view to a left, rear view. Pulling back on the coolie-hat switch actually toggles between the left-rear and right-rear views.

Outside or Chase Views



Pressing the `F3` key moves the viewpoint outside and behind the fighter in what is called a "chase view." Chase views of your aircraft are from outside or from the vantage point of another aircraft. Using the coolie-hat switch on your control stick or pressing the `2`, `4`, `6`, or `8` keys on your keypad allows the point of view to orbit the fighter. The `Page Up` zooms the view closer to the plane, and the `Page Down` key zooms the view farther away from the plane.

View Other Aircraft

All other aircraft in a given mission may be viewed by cycling the `0` key. Once the aircraft has been selected, you may use the coolie-hat switch or number key pad to orbit around to the different views.

Target View Lock

Target lock will automatically change your in-cockpit view to track the aircraft currently displayed on your GCI/compass instrument. The target is also indicated with a highlight box to pick it out of a group of aircraft.

SECTION 5 – BASIC AERODYNAMICS

If you have no flight simulator expertise or if y
craft in LUFTWAFFE COMMANDER, this Section is ju
success of air combat largely depends on basic
take too close a look at the theory of flight, but w
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nuances of piloting. Prior to describing pilotin
elementary information relating to flight and c
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Aircraft External Controls

The rudder is located on the trailing edge of th
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aircraft yaw smoothly to the right and will als
Notice that the same pedals are used on the g
rudders move automatically, you must select
Note: Auto rudders will coordinate all airborn
turn the aircraft on the ground when taxiing.

Ailerons are located on the outer trailing edg
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lage by deflecting these control surfaces up and
left or right, or by using the left and right arro
move the left aileron down and the right ailero
to the left.

The elevator is located on the trailing edge of
surface up and down will cause the nose of th
Pulling the stick back or pressing the down a
up which will cause the nose to pitch up.

Flight Dynamics

In level flight the aircraft moves without roll a
act on the aircraft as it moves through the ai

Thrust

Thrust is the aerodynamic force which propel
Luftwaffe Commander aircraft this is provide
driven aircraft engine, however, in the Me
created by an early jet engine.

Lift

Lift is the force that allows aircraft to stay i
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more flat lower surface of the wing. This is b
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Pressing the [8] key, or moving the
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view to track the aircraft cur-
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SECTION 5 – BASIC AERODYNAMICS

If you have no flight simulator expertise or if you have any difficulties flying the aircraft in LUFTWAFFE COMMANDER, this Section is just what you need. In the long run, the success of air combat largely depends on basic piloting skill. In this Section we'll not take too close a look at the theory of flight, but we shall give you the minimum of information necessary to understand the terminology and the description of techniques and nuances of piloting. Prior to describing piloting technique, we shall touch briefly on elementary information relating to flight and control of the aircraft. If you are closely acquainted with the theory of flight and general aircraft design, skip this section.

Aircraft External Controls

The rudder is located on the trailing edge of the vertical tail of the aircraft. The movement of the rudder pedals achieves rudder deflection. Right rudder input will make the aircraft yaw smoothly to the right and will also induce a slow roll effect to the right. Notice that the same pedals are used on the ground to taxi. If you wish to have your rudders move automatically, you must select auto rudders from the options menu. Note: Auto rudders will coordinate all airborne turns but you will still be required to turn the aircraft on the ground when taxiing.

Ailerons are located on the outer trailing edges of the wings of the aircraft you will have an opportunity to fly in LUFTWAFFE COMMANDER. The aircraft will roll about its fuselage by deflecting these control surfaces up and down. This is done by moving the stick left or right, or by using the left and right arrow keys. Moving the stick to the left will move the left aileron down and the right aileron up which will cause the aircraft to roll to the left.

The elevator is located on the trailing edge of the horizontal tail. Moving this control surface up and down will cause the nose of the aircraft to move, or pitch, up or down. Pulling the stick back or pressing the down arrow key will cause the elevator to move up which will cause the nose to pitch up.

Flight Dynamics

In level flight the aircraft moves without roll and yaw at a constant altitude. Four forces act on the aircraft as it moves through the air.

Thrust

Thrust is the aerodynamic force which propels aircraft through the air. For most of the Luftwaffe Commander aircraft this is provided by a propeller being turned by a piston-driven aircraft engine, however, in the Me 262 thrust is provided by exhaust gases created by an early jet engine.

Lift

Lift is the force that allows aircraft to stay in the air. When air moves over the wing, the air speed above the upper arched surface of the wing is higher than under the more flat lower surface of the wing. This is because the air above the wing has to travel faster to meet the air flow under the wing at the trailing edge of the wing. In accordance to aerodynamic laws, the faster the air speed, the lower the pressure. This means that the air pressure above the wing drops while the pressure under the wing remains normal. This difference in air pressure produces a force called lift acting in the direction of the low pressure area, that is, towards the upper surface of the wing. Therefore, the faster air moves over the wing the greater the lift.

Lift also depends on the angle at which the wing moves through the air, this angle is known as the Angle Of Attack (AOA). The greater the AOA, the greater the force of lift. However, at high angle of attack the air flow over the wing surfaces can start to break up, which can result in a stall (we'll discuss this later).

Gravity

Gravity is the force that attracts an aircraft (and any other object) to the ground. To fly at a constant altitude gravity should be balanced by the aircraft's lift. If something upsets this balance, excess lift will cause the aircraft to climb, and excess gravity will cause it to descend.

Gravity is measured in Gs. One G is equal to the normal force of gravity acting upon aircraft flying straight and level, thus, 5 Gs would be a force equal to five times the normal force of gravity. This can happen if you pull a hard turn, when centrifugal force adds more inertia induced gravity to your aircraft. Such increased gravity is called G load or G. As you pull more Gs, your weight increases correspondingly. This means that at 5 Gs your head, for example, weighs 5 times the ordinary.

Note that high Gs may result in the pilot's loss of consciousness. If you experience G loads acting in the direction from your head towards your feet (positive Gs) the blood leaves you head. In so doing, your vision will lose color, and finally everything goes black. The screen fades to black simulating a blackout. If you pitch down hard from level flight your weight will lessen. At some moment your body will weigh nothing, i.e., you'll be experiencing 0 Gs. If a downward pitch continues, your pilot experiences negative Gs, when the blood rushes to his head. When you push -2 or -3 Gs everything turns slightly red (in the pilot's eyes and on the screen). This condition is known as redout. The human body can stand up to 9 positive Gs without severe consequences, however, the limit for negative G-load is only 5 Gs. The longer you hold high G-loads, the harder it becomes to resist blackout/redout and the faster your body tires.

Note: Gravity induced loss of consciousness (GLOC) only occurs if that option is made active on the Options menu.

Drag

Drag is resistance to the forward movement of the aircraft. The amount of drag depends on many factors: a difference between pressures on the leading and trailing edges of the wing, air viscosity, and the arrangement of weapons on the aircraft's pylons (friction drag, or parasitic drag), as well as on the lift and AOA (induced drag).

Parasitic drag is a function of a particular aircraft's size and shape and is a major concern of aircraft designers. Normally, the greater the frontal area of the aircraft, the higher the drag.

Induced drag is produced by lift and is bo
wingtips (turbulence), which produce extr
by the air flow from the lower surface of t
The higher the AOA (and hence lift), the
words, the amount of induced drag. In leve
fore an increase in aircraft weight leads t

For level flight at a constant speed, it is
thrust. Drag is proportional to the square
geometrically with increase in airspeed re
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Principal Angles

The aircraft's motion in space can be det

To describe these various angles, it is m
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The angle of attack (AOA) is the angle be
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AOA, the greater the lift and drag, and h
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The pitch angle is measured between th
Note that pitch angle is not the same as
between the air flow (or velocity vector)
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Besides AOA, another angle describing
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Induced drag is produced by lift and is bound up with the forming of vortices on the wingtips (turbulence), which produce extra drag. The generation of vortices is caused by the air flow from the lower surface of the wing to the upper one over the wingtip. The higher the AOA (and hence lift), the greater the intensity of turbulence, in other words, the amount of induced drag. In level flight gravity is compensated by lift, therefore an increase in aircraft weight leads to an increase in the induced drag.

For level flight at a constant speed, it is necessary that drag should be balanced by thrust. Drag is proportional to the square of the airspeed and, hence, drag increases geometrically with increase in airspeed requiring ever greater thrust levels. As altitude increases, the drop in air density leads to a decrease in drag and hence to an increase of true airspeed required to maintain level flight at a constant AOA. Note, that indicated airspeed in this situation remains constant.

Principal Angles

The aircraft's motion in space can be determined by a set of angles.

To describe these various angles, it is more convenient to use the vector of velocity rather than air flow. The velocity of the aircraft is always opposite to the direction of the air flow and equal to it in the absolute value. The flight path is a trajectory of motion of the aircraft's center of mass, that is the point where all the forces acting upon the aircraft are applied.

The angle of attack (AOA) is the angle between the aircraft's longitudinal axis and the direction of its motion, i.e. the velocity vector. Up to a certain degree, the greater the AOA, the greater the lift and drag, and hence the increase in thrust required to maintain a constant speed. If the aircraft flies at a high AOA, the airflow cannot conform to the upper surface of the wing and forms turbulent vortices. The wing starts to lose its performance, and this can potentially result in a dangerous stall or spin and, probably, in catastrophe.

The pitch angle is measured between the horizon and the aircraft's longitudinal axis. Note that pitch angle is not the same as the angle of climb which indicates the angle between the air flow (or velocity vector) and the horizon. This angle is also called flight path angle which when added together with the AOA, constitute the pitch angle. Therefore, in level flight the angle of climb is equal to zero.

Besides AOA, another angle describing aircraft motion is the slip angle. This angle characterizes the asymmetry of airflow passing over the aircraft. This angle may sometimes coincide with the yaw angle.

Takeoff

Takeoff does not usually present too many difficulties even for beginners. In due course, this procedure will become second nature and will not require much attention. Now you are sitting in the cockpit ready for takeoff. Here we go!

1. Extend the flaps into the takeoff position using the F key. Lowering the flaps is not necessary if your payload is light. Start the engine with the W key.
2. Throttle up to military power by pushing the throttle lever fully forward or pressing the 0 key (100%).
3. On reaching maximum RPM (check RPM Indicator) release the wheel brakes by pressing the B key.
4. When the aircraft accelerates to take off speed, (refer to individual aircraft specifications for take off, stall, and landing speeds) begin the takeoff by smoothly pulling back on the stick. The nose should rise smoothly. Check attitude when air speed begins to drop off, nose down slightly and let the aircraft accelerate in this attitude.
5. When the wheels have lifted off the runway and the rate of climb is positive, raise your landing gear by pressing G, and at an altitude of about 100 meters set your flaps to neutral with the F key.

To get a good idea of how to do it right, and to earn your Pilot Badge, select Training on the Main Campaign screen. After an initial climb, you usually level off by easing forward on the stick and continue to accelerate until the aircraft reaches cruising speed. On reaching a safe altitude and a comfortable cruise speed you're set to practice some gentle maneuvers.

Maneuvers

Roll

While executing a roll, the aircraft is turning about its longitudinal axis by 360° keeping the general direction of flight.

1. Airspeed from 200 to 400 km/h. Smoothly pull the stick back to 10-15° nose up pitch angle. Fix the aircraft in this attitude briefly by very slightly pushing forward on the stick beyond the neutral position.
2. Deflect the stick to the desired direction keeping a rate of rotation at 60-70°/sec.
3. Recover wings level and pitch angle of -2° to 0°.

Banked Turn

To execute this simple maneuver precisely can prove to be trickier than it looks. To execute this horizontal maneuver it is necessary for the aircraft's vertical lift component to be equivalent to the force of gravity acting on the aircraft. The values of lift and bank angle determine the value of this component: the greater the bank angle, the less the vertical component of lift, and hence more lift is required to "lengthen" the vector of the vertical lift component. The G-load required to produce extra lift and thereby execute a banked turn is one of the main parameters of the maneuver. It increases non-linearly with the increase of bank angle. The rate of turn (RT) is one of the main characteristics of a banked turn and is measured by the number of degrees the aircraft turns per second at constant airspeed. This is not the same as instantaneous rate of turn which can be sustained for less time due to rapid loss of airspeed. In principle, the radius of a banked turn is proportional to the ratio of the square of the true airspeed to G-load.

To keep a steady speed executing a banked
sates drag. Therefore, pulling Gs during a ba
to compensate for the increased induced dra

Technique of piloting

1. For a right-hand turn, deflect the stick t
   to 45°. Return the stick to the neutral po
   stick to initiate a steady rotation.
2. Track the horizon constantly and main
   nose starts to descend reduce the angle
3. To recover from the turn in a coordinat
   the left. Track the horizon constantly!

Note that the use of rudder, if manual rudde
fly very accurately. For example, initiating a
of left rudder at the initial phase, and rolling
This is nearly impossible to do accurately
pedals, or a stick with rudder control, then
ple rule, "slip ball to the left, foot to the left".
bank indicator goes left, you should push th

Loop and Half-loop

Before starting a loop make sure your wings a
Note: Some earlier planes such as an He-51

1. Pull smoothly back to the moment of
2. As you go past vertical, gradually red
   loop 1.5-2 Gs. Keep the AOA at ~15°.
3. Passing the top point, it is necessary to
   ing part of the maneuver. Look for th
   85% or less and smoothly increase ba

To perform a half-loop, ascend as descri
uppermost point. This should be done at a
craft settles on the horizon. Before executi
reduce G-load.

Reverse Turn

A reverse turn is basically a half-roll to in

1. At speeds from 300 to 500 km/h hal
   too much power!
2. Smoothly pull back on the stick. Mai
   your looking for optimum rate of turn
3. When recovering from the reverse t
   and return it to the neutral position.

To keep a steady speed executing a banked turn, it is necessary that thrust compensates drag. Therefore, pulling Gs during a banked turn requires an increase in thrust to compensate for the increased induced drag.

Technique of piloting

1. For a right-hand turn, deflect the stick to the right, thus banking the aircraft, say, to 45°. Return the stick to the neutral position and start a smooth pull back on the stick to initiate a steady rotation.
2. Track the horizon constantly and maintain a pitch angle of 0°, if possible. If the nose starts to descend reduce the angle of bank slightly.
3. To recover from the turn in a coordinated manner, move the stick forward and to the left. Track the horizon constantly!

Note that the use of rudder, if manual rudder has been selected, becomes essential to fly very accurately. For example, initiating a left turn requires a smooth and slight input of left rudder at the initial phase, and rolling out of the turn requires the right rudder. This is nearly impossible to do accurately on the keyboard. If you possess rudder pedals, or a stick with rudder control, then feel free to use them and remember a simple rule, “slip ball to the left, foot to the left”. This means that if the ball of the turn and bank indicator goes left, you should push the left pedal forward.

Loop and Half-loop

Before starting a loop make sure your wings are level and that you have sufficient airspeed. **Note**: Some earlier planes such as an He-51 may have a difficult time performing a loop.

1. Pull smoothly back to the moment of reaching a pitch angle of 60°-80°.
2. As you go past vertical, gradually reduce G-load, trying to reach at the top of the loop 1.5-2 Gs. Keep the AOA at ~15°.
3. Passing the top point, it is necessary to correct any bank developed on the ascending part of the maneuver. Look for the horizon: as it goes past, throttle back to 85% or less and smoothly increase back pressure to 4 Gs.

To perform a half-loop, ascend as described above then execute a half-roll at the uppermost point. This should be done at a sufficient speed, when the nose of the aircraft settles on the horizon. Before executing a half-roll, ease forward on the stick to reduce G-load.

Reverse Turn

A reverse turn is basically a half-roll to inverted followed by a pull through.

1. At speeds from 300 to 500 km/h half-roll to inverted. Check horizon! Don’t use too much power!
2. Smoothly pull back on the stick. Maintain as much G as you need. But remember your looking for optimum rate of turn here, so high AOA is not necessarily the best.
3. When recovering from the reverse turn to level flight, smoothly release the stick and return it to the neutral position.

Spiral

A spiral is a maneuver, where the aircraft follows a spiral trajectory at relatively high angles of attack ascending or descending. A spiral is basically the same as a tight banked turn going up or down.

Practically, you should execute a descending spiral at a bank of 45-50°. This results in minimal loss of altitude at a turn through a particular angle, including the entry and recovery parts of a spiral. We do not recommend executing a descending spiral at a bank of more than 50° and at pitch angles of more than 20°.

To execute a descending spiral:

1. Slightly pull back on the stick to develop the desired angle of slope. Bank left or right.
2. While keeping the required bank angle, maintain your airspeed by increasing or reducing the G-load. Increase power if necessary. Should the aircraft start to behave oddly (drops the nose, rotates) or there is an increase of G-load, first reduce your bank angle.
3. Once you have reached the desired altitude, recover to level flight.

Stall and Spin

In order to stay airborne, an aircraft must produce enough lift. Flying at low indicated airspeeds and/or high angles of attack may result in the aircraft's inability to generate enough lift, which causes the aircraft to begin spontaneous oscillatory motion with large amplitudes, known as a stall. This phenomenon does not cease until the pilot reduces the AOA and may result in a spin - a steady-state critical mode of flight at high AOAs. An aircraft in a spin drops at high vertical velocity (50-100 m/s) along a steep and extended spiral of a small radius (from some meters to several tens of meters), while rotating about the center of mass.

The minimum speed, at which the aircraft is able to fly within its controllable flight envelope, is known as stall speed. It directly depends on air density and consequently has different values for different altitudes - the higher the aircraft is flying, the higher the stall speed (if considered as true airspeed).

At high angles of attack the aircraft can start to buffet in pitch, at extreme angles the buffet becomes relatively intense. This is due to air vortices breaking off the wing and disturbing the airflow. A spin can be upright (at positive AOAs) or inverted (at negative AOAs).

Depending on the aircraft's pitch angle, a spin can be steep or flat. An aircraft in a steep spin rotates with a yaw rate of about 30° per second, while descending at AOA of about 40-45° and at negative pitch angles of -30° to -50°. A flat spin is characterized by high yaw rate (60-80° per second) and high AOA (in excess of 45°). The aircraft's pitch angle in a flat spin does not exceed 30°. Typical steep and flat spins are shown on the figure below.

If the aircraft's AOA is too high, air cannot effectively flow around the wings to produce lift. One should take into account that increasing AOA to the values higher than 25° leads to a drastic drop in the efficiency of the ailerons — this in particular degrades the aircraft's bank control. At high AOAs and low airspeed we recommend that you

bank with the assistance of the rudder. Here
sideslip, contributing to the turn. To bank left,
to bank right, the right one. However, remem

1. An intensive rotation in the lateral and dire
pitch moment, which may cause an increa
2. High slip angles developed at an AOA
value, may lead to an earlier stall.
3. Deflecting the stick in the roll channel at
ational value, may result in the reverse a
banks right) and furthermore to an earli

Recovery from Stall and Spin

Note: To recover from a stall or spin, you shoul
recovery can take some time. This is the only w
ly recover from the spin, you may not have alti

Once you have noticed that your aircraft resp
horn continues to wail, proceed as follows:

1. Place the stick and rudder pedals into th
starts to drop.
2. If the aircraft starts to yaw and enters a
der pedals in the opposite direction. S
neutral position. Throttle back to idle.
3. If this does not help, push the stick fart
4. If the rotation does not ease in 5-6 secon
5. A final solution if the spin persists, bri
taining in spin aileron.
6. As soon as the rotation slows, which
rudder pedals and the stick to the neu
may result in entering a spin of the opp
on the stick to reduce the AOA.
7. After the AOA drops below the maximu
accelerates to 275-300 km/h, then po

If a stall occurs at negative angles of attac
the remedy is basically the same as describe
deflect the stick in pitch channel in the opp

Note On Good Airmanship

All aircraft of this type are designed to operat

- In a climb, to level off, don't just pus
the nose is on the horizon then roll o
- To enter a steep dive don't just push
and pull to the required dive angle, sa

Remember, pushing negative Gs is bad for

a spiral trajectory at relatively high
ral is basically the same as a tight

l at a bank of 45-50°. This results in
cular angle, including the entry and
executing a descending spiral at a
e than 20°.

ired angle of slope. Bank left or right.
tain your airspeed by increasing or
ssary. Should the aircraft start to
ere is an increase of G-load, first

ecover to level flight.

enough lift. Flying at low indicated
the aircraft's inability to generate
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o fly within its controllable flight
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be steep or flat. An aircraft in a
econd, while descending at AOA
to -50°. A flat spin is character-
AOA (in excess of 45°). The air-
Typical steep and flat spins are

flow around the wings to pro-
AOA to the values higher than
ns — this in particular degrades
peed we recommend that you

bank with the assistance of the rudder. Here banking occurs due to the creation of a sideslip, contributing to the turn. To bank left, you should press the left rudder pedal, to bank right, the right one. However, remember, that:

1. An intensive rotation in the lateral and directional channels produces a destabilizing pitch moment, which may cause an increase in AOA beyond the permissible limit.
2. High slip angles developed at an AOA approaching the maximum operational value, may lead to an earlier stall.
3. Deflecting the stick in the roll channel at AOAs approaching the maximum operational value, may result in the reverse action (you move the stick left, the aircraft banks right) and furthermore to an earlier stall.

Recovery from Stall and Spin

Note: To recover from a stall or spin, you should have sufficient height in hand. Indeed, as recovery can take some time. This is the only way, since even if you manage to successfully recover from the spin, you may not have altitude sufficient to recover from the dive.

Once you have noticed that your aircraft responds to control inputs badly and the stall horn continues to wail, proceed as follows:

1. Place the stick and rudder pedals into the neutral position and wait until the AOA starts to drop.
2. If the aircraft starts to yaw and enters a spin, counter it by deflection of the rudder pedals in the opposite direction. Slightly push the stick forward beyond the neutral position. Throttle back to idle.
3. If this does not help, push the stick farther forward. Maintain opposite rudder.
4. If the rotation does not ease in 5-6 seconds, deflect the stick in the direction of spin.
5. A final solution if the spin persists, bring the stick all the way back while maintaining in spin aileron.
6. As soon as the rotation slows, which may take about 5-10 seconds, release the rudder pedals and the stick to the neutral positions at once. Note that any delay may result in entering a spin of the opposite direction. Maintain forward pressure on the stick to reduce the AOA.
7. After the AOA drops below the maximum operational value, wait until the aircraft accelerates to 275-300 km/h, then power up and level off.

If a stall occurs at negative angles of attack and the aircraft enters an inverted spin, the remedy is basically the same as described above with the exception that you should deflect the stick in pitch channel in the opposite direction.

Note On Good Airmanship

All aircraft of this type are designed to operate under positive G-loads. Avoid the following:

- In a climb, to level off, don't just push on the stick! Execute a half roll, pull until the nose is on the horizon then roll out to straight and level.
- To enter a steep dive don't just push on the stick! Execute a half roll to inverted and pull to the required dive angle, say 45° nose down, then half roll back to erect.

Remember, pushing negative Gs is bad for the aircraft, bad for you and bad airmanship!

Iron Cross/Knight's Cross Aero Models

Luftwaffe Commander provides two main types of aerodynamic models, with the additional capability of turning on and off features of the Iron Cross model using the options menu. Iron Cross is designed to be the easier of the two menu models and is recommended for all beginners. In order to modify the aerodynamic realism settings you must be in Iron Cross. Knight's Cross, on the other hand, is the real aircraft aerodynamic model. This aero model gives you the best feel for what it was like to fly and fight some of these classic aircraft. Note: when flying in the Knight's Cross campaign mode you are required to fly Knight's Cross aero. Below is a list of options that may be turned on for Iron Cross, but are always part of the more advanced Knight's Cross aero model.

Inertial Effects

Whenever mass is put into motion, say by rolling your aircraft, it tends to stay in motion until acted on by another force. In the use of roll, inertia would require opposite inputs to side or curtail the aircraft roll. With Iron Cross this effect has been taken out to allow more concise control of your aircraft with less practice.

Overstress

It is possible under some conditions to overstress the airframe of your aircraft. This may be done by inducing a great deal of G or load on your aircraft by rolling out of a dive at high speed. In most uses your aircraft can handle more G than you can and would result in a loss of consciousness or black out before your wings came off.

Manual or Auto Rudders

Rudders are used to yaw the aircraft left and right about its center of mass. If auto rudders are selected, the rudders move to coordinate turns without pilot input, but are not available for side slip, a nice feature for dodging bullets or checking your rear position. Note: Auto rudders may be selected in the Knight's Cross aero model.

Spins

At slow airspeed or high angles of attach (AOA) your aircraft does not produce enough lift, which if not corrected causes your aircraft to stall.

The minimum speed at which an aircraft is able to maintain controllable flight is known as the stall speed. Once an aircraft stalls it may also spin depending on the severity of the stall and the aircraft altitude and configuration. To recover from a stall you must decrease the AOA and/or increase your airspeed. This may require a forward stick motion. All of the Luftwaffe aircraft are equipped with a stall horn as an audio indication of stall. To recover from a spin, place the stick and rudders in a neutral position and let the AOA drop. Once the rotation stops add power and pull out. If below 1,000 feet and still in a spin, bail out!

Cutout

Most German aircraft engines were designed with fuel injection which means, unlike the early Spitfires, they were not dependent on gravity to keep the engine fed with fuel. This means that negative G would not effect German engine performance, while the Spitfire's engine would sputter and loose power.

Cowl Flaps

When flying the Knightt's Cross aero
ed from the Options menu, this
flaps to use this option to impro
altitudes. They should be left open at low
closed at higher altitudes. When flying the
smoking at moderate or low altitude, try ope
engine off, or it can burn up.

Overheat

All engines are susceptible to overheat, espe
tude. For example, if the Bf-109 is operating
when on the ground to maximize the amou

Horse Power

With the Iron Cross aero model only it is possi
the weight cost, which increases the the pe
more acceleration and not as susceptible to

Aircraft Trim

Aircraft trim is used to allow your aircraft to
surfaces are in the neutral position. For exa
constant back pressure on the stick, you mu
a neutral position. Trim can be put in by us
Note: trim requirements change for a variety

Torque

Aircraft torque is produced by the rotation
power, as with take-off, require right-rudd
craft being pulled to the left.

Propeller Settings

The pitch may be set, if in the man
versus power settings and per
Commander the climb setting shoul

Ground Effect

As your aircraft gets close to the ground,
under your wings which generates more l
the runway on landing which would requir
craft on the ground during landing.

Wing Blanking

At high angles of yaw the chassis of your
of the trailing wing. This can be especially
used to make a low level, slow, heading c
induce stall which could cause your aircr

aerodynamic models, with the addi-
the Iron Cross model using the options
e two menu models and is recom-
e aerodynamic realism settings you
er hand, is the real aircraft aerody-
t feel for what it was like to fly and
g in the Knight's Cross campaign mode
a list of options that may be turned
advanced Knight's Cross aero model.

g your aircraft, it tends to stay in
of roll, inertia would require oppo-
Iron Cross this effect has been taken
with less practice.

the airframe of your aircraft. This
on your aircraft by rolling out of a
handle more G than you can and
before your wings came off.

bout its center of mass. If auto rud-
rns without pilot input, but are not
ets or checking your rear position.
ss aero model.

aircraft does not produce enough
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to maintain controllable flight is
may also spin depending on the
figuration. To recover from a stall
peed. This may require a forward
ed with a stall horn as an audio
ick and rudders in a neutral posi-
add power and pull out. If below

el injection which means, unlike
to keep the engine fed with fuel.
engine performance, while the

Cowl Flaps

When flying the Knightt's Cross aero model, or if Manual Cowl Flaps has been selected from the Options menu, this control allows planes equipped with cowl flaps to use this option to improve the aircraft's performance at different altitudes. They should be left open at low altitudes to provide greater cooling, and closed at higher altitudes. When flying the Knight's Cross model, if your engine starts smoking at moderate or low altitude, try opening your cowl flaps, Shift+C, to cool the engine off, or it can burn up.

Overheat

All engines are susceptible to overheat, especially if operated at high RPM and low altitude. For example, if the Bf-109 is operating with manual cowl flats, they must be open when on the ground to maximize the amount of cool air getting to the engine.

Horse Power

With the Iron Cross aero model only it is possible to have a larger engine without paying the weight cost, which increases the the performance of the aircraft. It is faster with more acceleration and not as susceptible to stalls and/or spins.

Aircraft Trim

Aircraft trim is used to allow your aircraft to maintain a given altitude when the control surfaces are in the neutral position. For example, if in level flight your aircraft requires constant back pressure on the stick, you must trim in order to fly level with the stick at a neutral position. Trim can be put in by using the + and - keys on the number pad. Note: trim requirements change for a variety of reasons, including aircraft airspeed.

Torque

Aircraft torque is produced by the rotation of the propeller. Large changes in engine power, as with take-off, require right-rudder to compensate for the nose of your aircraft being pulled to the left.

Propeller Settings

The pitch may be set, if in the manual position, to maximize fuel consumption versus power settings and performance requirements. For LUFTWAFFE COMMANDER the climb setting should be used for air combat.

Ground Effect

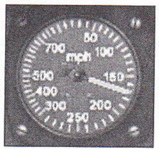
As your aircraft gets close to the ground, approximately 20 feet, air density builds under your wings which generates more lift. This may cause an aircraft to float down the runway on landing which would require more positive stick inputs to plant the aircraft on the ground during landing.

Wing Blanking

At high angles of yaw the chassis of your aircraft has a tendency to cancel out the lift of the trailing wing. This can be especially dangerous when landing if your rudders are used to make a low level, slow, heading correction. The resulting wing banking could induce stall which could cause your aircraft to flip inverted.

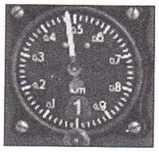
SECTION 6 – BASIC INSTRUMENTS

Airspeed Indicator



Under standard atmospheric conditions at sea level, the airspeed indicator shows the speed at which the aircraft is moving through the surrounding air mass. All German aircraft are calibrated in kilometers per hour as is the illustration on the left. It is important to remember that the American made P-39 and P-51 are calibrated in miles per hour as is the illustration on the right.

Barometric Altimeter



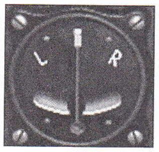
The altimeters used in this game are always set for a standard day. In other words, it displays the correct altitude above sea level based on standard day pressures. Note: The barometric altimeter does not show actual height above the ground only height above sea level and in the case of German aircraft that height would be calibrated in kilometers.

The small number window within the altimeter dial is in thousands of meters, or feet in an Allied plane. An indication of 5 with the needle and a small 3 displayed would be 3,500 meters. The conversion for kilometers to feet is 1,000 meters is 3,048 feet.

Vertical Speed Indicator

The VSI gives the speed at which your aircraft is climbing or diving in kilometers per minute. All the numbers on the face plate must be multiplied by 1,000. The upper half of the instrument displays a climb while the lower half shows a dive, and zero is level flight.

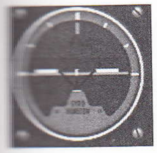
Turn and Bank Indicator with Balance Ball



The balance ball indicator shows directly and immediately the longitudinal alignment of the aircraft, nose to tail. This information allows you to use the rudders to eliminate yaw. Note: This simulation has auto rudders normally engaged unless manual rudders have been selected via the Options Menu.

The bank indicator needle shows aircraft bank and turn and is calibrated for a four-minute turn, that is, if the needle is deflected by one needle width it takes four minutes to turn 360 degrees.

tude Indicator



Some aircraft are
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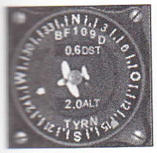
Compass / Ground Control Inte



The compass is u
degrees. You can d
the aircraft symbol

The compass in th
intercept (GCI) info

The GCI was designed to work hand
type, distance, and directional inform

Friend or foe may be cycled by usin
type, altitude in and distance in kilo
flying. Using the compass, directiona
heading Bug to fly towards a selected
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Engine RPM

The aircraft's RP
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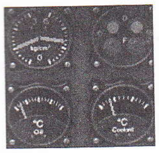
Engine Cluster Instrumentati



The engine cluste
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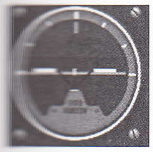
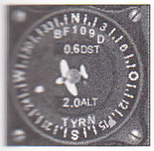
Attitude Indicator



Some aircraft are provided with an attitude indicator. The attitude indicator provides a visual indication of the aircraft's pitch and roll. If the horizontal symbol, which represents the wings, moves below the horizontal tic marks, the aircraft is climbing. If, on the other hand, the symbol moves above the horizontal tic marks, the aircraft is diving. In a bank, the wing symbol moves up one row of tic marks giving you the bank angle. The horizontal tic marks, represent wings level. The first one up represents 30 degrees, the next 60 degrees and the center tic mark represents 90 degrees of bank.

Compass / Ground Control Intercept (GCI)



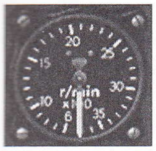
The compass is used to give the aircraft's heading through 360 degrees. You can determine your heading by reading the number off the aircraft symbol's nose and multiplying it by 10.

The compass in this simulation is also used to give ground control intercept (GCI) information on other aircraft.

The GCI was designed to work hand-in-hand with the compass to give you altitude, type, distance, and directional information on both friendly and hostile or foe aircraft.

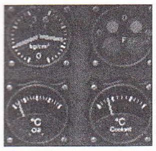
Friend or foe may be cycled by using by using the [I] key. The GCI displays aircraft type, altitude in and distance in kilometers or feet depending on the aircraft you are flying. Using the compass, directional information may also be obtained by using the heading Bug to fly towards a selected aircraft. Simply put the nose of your aircraft symbol on the heading Bug. Different friendly or foe aircraft may be selected by using the [T] key. Pressing [T] cycles through all aircraft of the current selection, friend or foe.

Engine RPM



The aircraft's RPM instrument gives an indication of the engine's revolutions per minute. All figures on the face should be multiplied by 1,000.

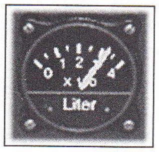
Engine Cluster Instrumentation for Props



The engine cluster may be broken down into three instruments or indications: oil and fuel pressure calibrated in kilos per meter and oil temperature calibrated in degrees Celsius. It is important that these indicators stay in the green.

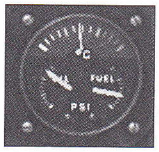
Fuel Quantity Gauges

German Fuel Quantity Gauge



The German fuel quantity gauge is calibrated in liters and each figure must be multiplied by 100. The gauge displays a maximum of 400 liters.

U.S. Fuel Quantity Gauge

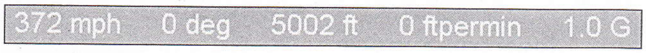


The U.S. fuel gauge is calibrated in U.S. gallons and each figure must be multiplied by 10 for maximum displayed.

Low Fuel Light

Some aircraft are equipped with a fuel low light. If so equipped it is illuminated to alert the pilot to a potential problem. The fuel low light is illuminated when the fuel quantity reaches 10% of the maximum fuel load.

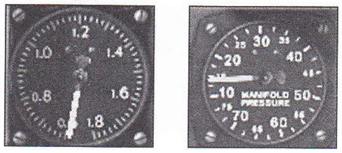
Chase View Information



372 mph 0 deg 5002 ft 0 ftpermin 1.0 G

When flying the Chase views or out of the cockpit views it is possible to monitor your altitude, airspeed, and heading.

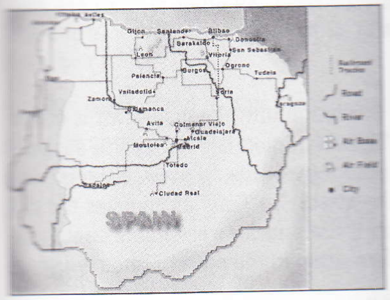
Manifold Pressure Indicator



Manifold pressure is primarily a function of power setting and altitude. Manifold pressure readings should be used to maximize performance and fuel consumption.

Gun Counter

Most LUFTWAFFE COMMANDER aircraft have gun counter or ammunition amount indicators. In the German aircraft they were designed to show the percentage of cannon or machine gun rounds left. Each represents 10% of the remaining ammunition. Each number in the array represents an actual gun, for example, if four numbers are shown, there are four machine guns or cannon.



through the area. Check your clock vers

Auto Pilot

Auto pilot may be used to hold your alti
looking down into your cockpit, your m
key activates the autopilot, pressing the

Form Augmentation Device (FAD

All Luftwaffe commander aircraft are e
FAD. Once selected, "FAD ON" is displa

The FAD can fly the selected formation
you. However, the formation is much m
trol inputs to aid the Device. Assume
engaged you are led to your target or h

FAD Formations

There are three different types of select
Left Echelon, And Trail. (Fig. 7-2)

The word formations may apply to a
craft). For example, most missions ar
formation. This formation is actually m
the other flying echelon right. (Fig. 7-2
selecting the formation of the rotte, i.e

Right Echelon

In the RIGHT ECHELON, your "lead" i
mation, when used by a schwarm, s
right side approach to the air strip m
the "break," "downwind," "base," "fi
landing first. The other aircraft in the

calibrated in liters and each fig-
he gauge displays a maximum of

in U.S. gallons and each figure
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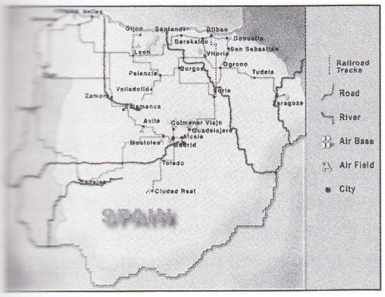
SECTION 7 – NAVIGATION / EMERGENCY



Navigation in the Luftwaffe Commander type aircraft relied on four basic things; tile compass, clock, map, and looking out the window. For single mission and Iron Cross campaign missions, a flashing aircraft icon shows you your exact position on the map. In Knight's Cross you have no such luxury. You must know where you're starting from, and be aware of your heading and airspeed. Get to know land marks, and use roads, railways, and rivers to navigate your way through the area. Check your clock versus airspeed to calculate the distance covered.

Auto Pilot

Auto pilot may be used to hold your altitude and heading. This is very important when looking down into your cockpit, your map, or if you become wounded. Pressing the A key activates the autopilot, pressing the key a second time disables the autopilot.

Form Augmentation Device (FAD)

All Luftwaffe commander aircraft are equipped with a Form Augmentation Device or FAD. Once selected, "FAD ON" is displayed for a moment as an overlay.

The FAD can fly the selected formation with the lead aircraft without any input from you. However, the formation is much more precise and smooth if you use small control inputs to aid the Device. Assume your lead is a good navigator so with FAD engaged you are led to your target or home.

FAD Formations

There are three different types of selectable flying formations. They are: Right Echelon, Left Echelon, And Trail. (Fig. 7-2)

The word formations may apply to a Rotte (two aircraft), or to a schwarm (four aircraft). For example, most missions are flown in a finger four formation or schwarm formation. This formation is actually made up of two rotte, one flying echelon left and the other flying echelon right. (Fig. 7-2) When selecting a FAD formation you are only selecting the formation of the rotte, i.e., you and your position relative to your lead.

Right Echelon

In the RIGHT ECHELON, your "lead" is to your left in a stepped up position. This formation, when used by a schwarm, supports the rapid landing of aircraft. A proper right side approach to the air strip may be made with the "lead" aircraft performing the "break," "downwind," "base," "final" and eventual "touchdown" phases of the landing first. The other aircraft in the element follow the "lead" in close succession.

Left Echelon

In the LEFT ECHELON, the "lead" aircraft is on your right. All other aircraft are staggered in a stepped down position to the left of the "lead" aircraft.

Trail

The TRAIL formation is a two aircraft or Rotte formation only. Your aircraft is directly behind the lead in a stepped down position. This formation is desirable in supporting attacks against slower moving, less maneuverable aerial targets and stationary/slow moving ground targets. Using the attack "in Trail" minimizes the risk of mid-air collisions that well could be a problem if the attacks were made simultaneously from all quarters. This is also the desired formation in the pattern once the break has been accomplished.

Wingman or Flight Lead Commands

If you are leading a Rotte, you have command of a wingman. If you are leading a Schwarm, or four aircraft, you have command of a wingman plus a Rotte Leader with a wingman. If either of these two situations occur, the following commands are available to you through the keyboard:

`F8` Commands your wingman or Flight to attack aerial threats encountered.

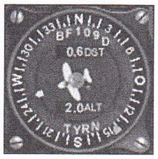
`F9` Commands your wingman or Flight to form up on your aircraft.

`F10` Commands your wingman to return to base.

`F11` Commands your wingman protect or cover your aircraft.

`F12` Commands your wingman or Flight to form up in a LEFT ECHELON position on your aircraft.

Select A New Lead



Every mission brief includes your default formation position based on your assigned lead, but it may become necessary to change leads based on combat or pilot preference. This can be done by first selecting "friend" on your compass GCI display using the `I` key to activate it. Pressing the `I` key more than once cycles between friendly and enemy forces. Now cycle through all the aircraft using the `T` key. Your current lead, if applicable, displays a green BUG instead of a yellow one on your aircraft compass. Once the aircraft you would like to designate as your leader is displayed on the GCI press `Shift` `L`. That BUG now turns green to confirm the new lead. Now the selection of the FAD causes your aircraft to fly the selected formation off this new lead. In order to switch back to your assigned lead, simply use the `L` key. It is impossible to select an enemy aircraft as a new leader.

Zapping

Zapping may be requested by using the `Z` Key. If approved, you are moved ahead on your flight plan to the next significant event, target area, rendezvous, or home field. Normal missions usually have just two Zap points.

The in-flight map should be referenced any
aircraft placement.

There are certain limitations that place a
listed below:

- Not authorized if your aircraft has low
- Not authorized if you are wounded.
- Not authorized if enemy aircraft are with
- Not authorized if pilot has not yet take

Ditching

When ditching is required, make a normal
than risk detection over enemy territory wh
the safe bailout area and adds to the likelih

1. FAD - Off
2. A.P. - Off
3. Flaps -Down full
4. Gear – Up (except He-51)

Note: The P-51 Mustang, Bf 109E, and Sp
ditch in the water without resulting in dea

Wounded Pilot

In the event that you are wounded, every
bailout area prior to exiting the aircraft. It
on A.P. for periods of unconsciousness as
work during this time.

Note: At some point the wounded pilot w
which results in the destruction of the airc

Target Identification/Getting the S

Aircraft can be seen at a maximum distanc
itive identification is impossible. You must
locate and identify your targets. The GCI i
the information you need including the pi
target tracking option active, whatever airc
with a green glint box to help you with tar
.3 miles or the range of your weapons. Onc
is necessary to lead it by placing your gun
craft. Pulling the nose of your aircraft into
of the turning aircraft to do this. Once in ra
the range, then pour on the cannons, if y
limited cannon rounds, and makes sure th

ght. All other aircraft are stag-
" aircraft.

n only. Your aircraft is direct-
nation is desirable in support-
verable aerial targets and
k "in Trail" minimizes the risk
attacks were made simultane-
n in the pattern once the break

ingman. If you are leading a
man plus a Rotte Leader with
llowing commands are avail-

threats encountered.

our aircraft.

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LEFT ECHELON position on

ult formation position based
ne necessary to change leads
This can be done by first
l display using the [I] key to
than once cycles between
hrough all the aircraft using
een BUG instead of a yellow
ld like to designate as your
v turns green to confirm the
aft to fly the selected forma-
gned lead, simply use the [L]
eader.

d, you are moved ahead on
rendezvous, or home field.

The in-flight map should be referenced anytime a Zap is performed to ensure proper aircraft placement.

There are certain limitations that place a restraint on the use of the Zap, they are listed below:

- Not authorized if your aircraft has low fuel state.
- Not authorized if you are wounded.
- Not authorized if enemy aircraft are within a perimeter of 1/2 mile of your aircraft.
- Not authorized if pilot has not yet taken off.

Ditching

When ditching is required, make a normal approach with power, if possible. Rather than risk detection over enemy territory while hanging from a chute, ditching expands the safe bailout area and adds to the likelihood of being rescued.

1. FAD - Off
2. A.P. - Off
3. Flaps -Down full
4. Gear – Up (except He-51)

Note: The P-51 Mustang, Bf 109E, and Spitfire, because of their air scoops, cannot ditch in the water without resulting in death.

Wounded Pilot

In the event that you are wounded, every attempt should be made to reach a safe bailout area prior to exiting the aircraft. It is recommended that you place the aircraft on A.P. for periods of unconsciousness as the Form Augmentation Device does not work during this time.

Note: At some point the wounded pilot will pass-out and not regain consciousness, which results in the destruction of the aircraft..

Target Identification/Getting the Score

Aircraft can be seen at a maximum distance of 12 miles, but of course at this range positive identification is impossible. You must use your compass / GCI instruments to help locate and identify your targets. The GCI instrument, covered in Section 6, displays all the information you need including the pilot's skill, if you are in Iron Cross. With the target tracking option active, whatever aircraft is designated on your GCI is illuminated with a green glint box to help you with target tracking. This box turns off at a range of .3 miles or the range of your weapons. Once in range, if your target is in a hard turn, it is necessary to lead it by placing your gun sight in the forward path of the turning aircraft. Pulling the nose of your aircraft into a tighter turn, point your gun sight in front of the turning aircraft to do this. Once in range you might use your machine-guns to find the range, then pour on the cannons, if your aircraft is so equipped. This saves your limited cannon rounds, and makes sure they are most effective.

■ SECTION 8 – SPAIN

Spanish Civil War

In July 1936 the Spanish Army, under General Francisco Franco, revolted and began the Spanish Civil War. The opposing factions were basically the "Rightist" rebels (Nationalists) and the "Leftist" (Royalists) which supported the existing government. France and Russia supported the Royalists; France supplied small arms while Russia responded by sending planes and tanks. The Nationalists were supported by the anti-communist governments of Germany and Italy; Italy responded by sending troops, planes, pilots and tanks while Germany, recognizing an opportunity to test the new Luftwaffe under combat conditions, sent both planes and pilots.

Initial German support to General Franco's forces involved the loan of several Junker's Ju-52 aircraft to support the transportation of 1000 rebel troops from Morocco to Spain. This was followed by the shipment of six Heinkel He-51 biplane fighters with six pilots and an additional eleven Ju-52 transports in late 1936. In the meantime, Russian fighters, namely the I-15 ("Chato"), I-16 ("Moska") and I-153 ("Chaika") arrived in Spain, were immediately put into service by the Royalists and soon proved the obsolescence of the German He-51 aircraft.

Despite the arrival of more pilots and He-51 fighters, the Luftwaffe continued to be out-classed and out-numbered by the Russian aircraft. As a result, the Luftwaffe command shipped a new Messerschmitt Bf-109 fighter to Spain to evaluate its combat capability; it was assigned specifically to Hannes Trautloft, one of the six original He-51 pilots sent to Spain to aid the Nationalists. He prepared many reports on the Bf-109B and was considered instrumental in the improvement of the performance/combat readiness of this famous fighter aircraft.

The Bf-109 design evolved from the Me-108 "Taifun," a sleek 4-place, low-wing monoplane of the early 1930's that featured all-metal construction, retractable landing gear, leading edge slats and slotted landing flaps.

The "Taifun" designer, Willi Messerschmitt, was a friend of Rudolph Hess, the third-ranking member of the Nazi Party. Hess put on an aerobatics display near Berlin in the "Taifun" that resulted in a contract award to Messerschmitt for 35 "Taifuns" for use as trainers and personal transports for military brass.

The prototype Bf-109 made its initial flight in September of 1935 and, as strange as it may seem, it was powered with a British Rolls-Royce Kestral V engine, because the intended German Junkers Jumo engine was not available at the time.

Later, after engine changes, the Bf-109 compe
at Zurich, Switzerland where it astounded the
the following categories:

1. Speed Competition - four laps around a
   average speed of 254 mph (powered wi
2. Alpine Circuit for Formations of Three A
   in an elapsed time of 58 minutes and 5
   Jumo engine).
3. International Circuit of the Alps - com
   elapsed time of 56 minutes and 47 secon
   engine).
4. Climb and Dive Competition - climb fr
   1000ft. in an elapsed time of 2 minutes
   Benz DB-601 engine).

After being retrofitted with a more powerfu
lished a new world speed record for aircraft

Early in 1937, Germany further supported
expeditionary force to Spain. This force w
drawn mostly from the Luftwaffe; it compris
port, liaison and reconnaissance units.

Adolph Galland, who later became a high
the four staffel (squadron) leaders within t
victory total of seven while serving in Spain
result of flying combat in WWII, his aerial v

To provide combat experience to as many p
the Condor Legion personnel and in May, 1
a staffel leader.

Molders was a master air tactician and s
fighter formations to be compatible with th
Bf-109 fighter, which was now beginning to
he replaced the existing Luftwaffe "Kette,"
with the "Rotte," a two plane element consi
loose formation, approximately 600 ft. apar

Two Rotte made up a four element format
consisted of an attack Rotte and a secondar
protect the attack Rotte.

The Luftwaffe Schwarm when viewed fro
located and flying in the positions of the
hand (palm down) with the fingers straigh
formation was known as the "Finger Four
Attack System" in the USAAF.

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basically the "Rightist" rebels
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reports on the Bf-109B and
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ion, retractable landing gear,

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tics display near Berlin in the
itt for 35 "Taifuns" for use as

of 1935 and, as strange as it
estral V engine, because the
at the time.

Later, after engine changes, the Bf-109 competed in the 1937 International Flying Meet at Zurich, Switzerland where it astounded the aviation world by winning first place in the following categories:

1. Speed Competition - four laps around a three and a half mile circuit course at an average speed of 254 mph (powered with a 635 hp Junkers Jumo engine).
2. Alpine Circuit for Formations of Three Aircraft - completing a flight of 228 miles in an elapsed time of 58 minutes and 5 seconds (powered with a 635 hp Junkers Jumo engine).
3. International Circuit of the Alps - completing a 228 mile circuit course in an elapsed time of 56 minutes and 47 seconds (powered with a 635 hp Junkers Jumo engine).
4. Climb and Dive Competition - climb from 1000ft. to 9800ft. then dive back to 1000ft. in an elapsed time of 2 minutes and 5 seconds (powered with a Daimler-Benz DB-601 engine).

After being retrofitted with a more powerful Daimler-Benz engine, the Bf-109 established a new world speed record for aircraft of 379.38 mph in November, 1937.

Early in 1937, Germany further supported Franco's forces by sending a complete expeditionary force to Spain. This force was called the "Condor Legion" and was drawn mostly from the Luftwaffe; it comprised bomber, fighter, ground-attack, transport, liaison and reconnaissance units.

Adolph Galland, who later became a high-ranking Luftwaffe general, was one of the four staffel (squadron) leaders within the Condor Legion and achieved an aerial victory total of seven while serving in Spain during the Spanish Civil War. Later, as a result of flying combat in WWII, his aerial victories would increase to 104.

To provide combat experience to as many pilots as possible, Luftwaffe officials rotated the Condor Legion personnel and in May, 1937, Werner Molders replaced Galland as a staffel leader.

Molders was a master air tactician and soon realized the need for developing new fighter formations to be compatible with the vastly improved performance of the new Bf-109 fighter, which was now beginning to arrive in increasing numbers. To this end, he replaced the existing Luftwaffe "Kette," which was a tight, three plane, v-formation with the "Rotte," a two plane element consisting of a leader and his wing-man flying a loose formation, approximately 600 ft. apart.

Two Rotte made up a four element formation that was known as the "Schwarm;" it consisted of an attack Rotte and a secondary Rotte which served in a defensive role to protect the attack Rotte.

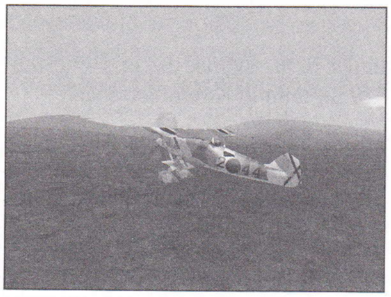
The Luftwaffe Schwarm when viewed from above, would appear to have the planes located and flying in the positions of the four fingers of an outstretched, horizontal hand (palm down) with the fingers straight and slightly spread. This advanced flying formation was known as the "Finger Four Formation" in the RAF and as the "Double Attack System" in the USAAF.

With the increased number of Bf-109 fighters and the incorporation of the advanced Schwarm fighter tactics, the German pilots quickly achieved aerial supremacy. As a result, Franco's forces reached the French border in early February, 1939 which signaled the end to the Spanish Civil War.

The Luftwaffe's performance during the Spanish Civil War, which was achieved through the utilization of the advanced Bf-109 fighter and the Schwarm fighter tactics of Werner Molders, earned the German Air Force the reputation as the most battle-proven, efficient and best-led air-force in the world.

Werner Molders survived the Spanish Civil War as the top German ace of that conflict, with an aerial victory total of 14. Later, as a result of his WWII combat flying, his aerial victories would reach 115 before his life ended in a tragic flying accident.

The German He. 51



The Heinkel He. 51, manufactured by Ernst Heinkel AG, first flew in the summer of 1933. It was a single-seat, open-cockpit, bi-plane fighter with a fixed main landing gear and tailskid. It was powered with a BMW VI, 12 cylinder V, liquid-cooled engine. It possessed conventional staggered wings, with the top wing having a greater span than the bottom, and weighed 4200 pounds.

Upon the conclusion of initial flight tests, it was chosen as the front-line fighter for the Luftwaffe and first saw action in Spain in 1936 where a total of 135 of these aircraft supported General Francisco Franco's Nationalist forces and the German Condor Legion.

In the era of bi-plane fighters, it was fast and maneuverable; however, during combat in Spain, it proved inferior to the Russian Polikarpov I-15/I-16 fighters and was removed from front-line service in 1938.

Prior to the termination of production, approximately 700 of these aircraft were manufactured.

Performance:
  Max Speed: 225mph
  Service Ceiling: 25,200ft.
  Range: 350miles

Dimensions:
  Span: 36ft.
  Length: 27ft. 6in.
  Height: 10ft. 6in.

Armament: Two 7.92-mm. (0.31in.) machine-guns mounted in the top of the engine cowling.

Fighting with the He. 51: The He.51 utili
construction and therefore it could not wi
was under-powered, aerodynamically unc
our climb rate. All He 51 pilots should k
attacking other aircraft. If you should giv
speed and altitude are lost there is a very
the best method of attack would incorpo
battle damage and effect a quick and saf

Bf 109D-2

Performance:
  Max Speed: 480 km/h at sea level
  575 km/h at 3500 m (
  Normal Cruise: 370 km/h at 3600
  Service Ceiling: 10,000 m (32,810
  Max Range: 560 km (348 miles) Ra

Dimensions:
  Span: 9.87 m (32 ft. 4 1/2 in.)
  Length: 8.55 m (28 ft. 0 5/8 in.)
  Height: 2.45 m (8 ft. 1/2 in.)

Armament: Four MG 17 machine-guns;
  Two were cowl-mounted an

Fighting with the Bf 109D-2: The prima
Spain were the Polikarpov I-15 Chato (F
(fly) or Ratta, (rat) as it was called by th

e incorporation of the advanced
chieved aerial supremacy. As a
early February, 1939 which sig-

ivil War, which was achieved
and the Schwarm fighter tactics
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top German ace of that conflict,
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ottom, and weighed 4200

as the front-line fighter for the
a total of 135 of these aircraft
ces and the German Condor

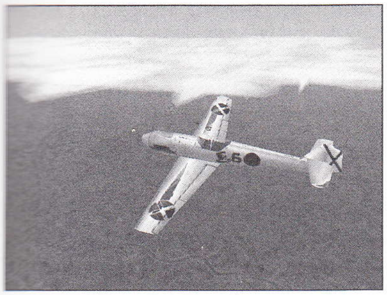
able; however, during combat
I-15/I-16 fighters and was

0 of these aircraft were man-

ted in the top of the engine

Fighting with the He. 51: The He.51 utilized fabric covering as opposed to all-metal construction and therefore it could not withstand much battle damage. Additionally, it was under-powered, aerodynamically unclean and did not possess a high diving speed nor climb rate. All He 51 pilots should keep their airspeed as high as possible when attacking other aircraft. If you should give up altitude, do so begrudgingly. Once airspeed and altitude are lost there is a very good chance that the battle is as well. Thus, the best method of attack would incorporate a hi-speed, diving pass to inflict major battle damage and effect a quick and safe disengagement.

Bf 109D-2



The Bf 109D-2 fighter was produced as a stop-gap aircraft while waiting for the Bf 109E, which was delayed due to the shortage of the new Daimler-Benz 600 series engine. With this in mind the German Air Ministry decided to produce a limited number of 109Ds, using the Jumo 210D and 201G engines. The switch to the Jumo engines meant a loss in overall performance and without an automatic supercharger the engine would cut out under high G loads.

Performance:
Max Speed: 480 km/h at sea level (298 mph)
575 km/h at 3500 m (357 mph at 11,480 ft.)
Normal Cruise: 370 km/h at 3600 m (230 mph at 11,810 ft.)
Service Ceiling: 10,000 m (32,810 ft.)
Max Range: 560 km (348 miles) Range

Dimensions:
Span: 9.87 m (32 ft. 4 1/2 in.)
Length: 8.55 m (28 ft. 0 5/8 in.)
Height: 2.45 m (8 ft. 1/2 in.)

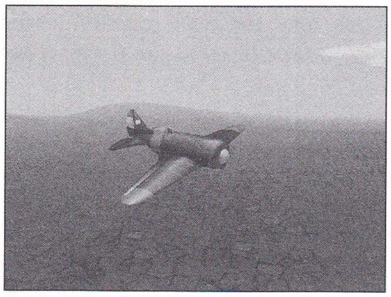
Armament: Four MG 17 machine-guns;
Two were cowl-mounted and one was mounted in each wing

Fighting with the Bf 109D-2: The primary adversaries of the He 51 and the 109D in Spain were the Polikarpov I-15 Chato (Flat-nosed one) and the Polikarpov I-16 Moska, (fly) or Ratta, (rat) as it was called by the German pilots.

I-15

Over 500 I-15 fighters were sent to Spain in 1936 to aid the Republican, or Loyalist forces. With a top speed of 224 mph, the Chato was not nearly as fast as the 109D, but it was exceptionally maneuverable. When fighting the Chato it is important to remember not to get into a turning fight, especially with the higher ranking pilots such as the Staffelkapitan, (STKP) or Squadron Commander, and a Jagdführer, (JAFU) or Flight Leader. A turning fight will result in the I-16 putting 7.6 mm rounds from its two cowl-mounted machineguns into your backside. In short, the 109D-2 is a much better fighter; it has more fire power, is more durable, and can out-dive the much slower Chato, but beware of a Chato's ability to maneuver.

I-16



The I-16 or Rata (Rat) was the first low wing single seat fighter with retractable landing gear in any air force. Its air-cooled radial engine would allow the nimble little fighter to reach a maximum speed of 280 mph with a service ceiling in excess of 26,000 ft. The aircraft is very durable and has an excellent rate of climb, but it is very unstable in long turns or climbs. You should fight the Rat with extended climbs, dives, and 180-degree turns. Be very leery of this stub-by little fighter, many experts believe this to be the most difficult Soviet fighter to shoot down, with its tight turns and slow speed.

SECTION 9 - FRANCE

Battle of France

The Battle of France began on May 10, 19
strikes on various Allied air bases resulting
Belgium aircraft on the ground. Additiona
supremacy and disposed of most Allied ai

The Battle of France lasted approximately
1940 and it represented a time that was
military aviation. The short duration of th
German air superiority, which paved the
Panzer Divisions. The final result was the
British troops on the beaches at Dunkirk.

The Dunkirk escape, the evacuation of the
made possible by two factors:

1. The initial combat appearance of the
ed better air coverage during the eva
2. The short combat range of the Bf-1
which prevented many of these airc
pating in combat sorties over the Du

While Allied air units were able to destro
ing the Battle of France, French losses we
450 aircraft. On this basis, there was
Luftwaffe over the Allied air forces.

The most successful German fighter pilo
Balthasar, who had scored 7 aerial victo
gained 23 more aerial victories and dest
ground while flying combat in France. He
47 prior to losing his life in a combat cra

Bf 109E-1

SECTION 9 - FRANCE

Battle of France

The Battle of France began on May 10, 1940. On this date the Luftwaffe instituted air strikes on various Allied air bases resulting in the destruction of numerous French and Belgium aircraft on the ground. Additionally, the Luftwaffe quickly established aerial supremacy and disposed of most Allied aircraft that did manage to get aloft.

The Battle of France lasted approximately six weeks (from May 10 through June 22, 1940 and it represented a time that was to prove the worst in the history of French military aviation. The short duration of this battle was most certainly attributable to German air superiority, which paved the way for the rapid advance of the German Panzer Divisions. The final result was the entrapment of roughly 300,000 French and British troops on the beaches at Dunkirk.

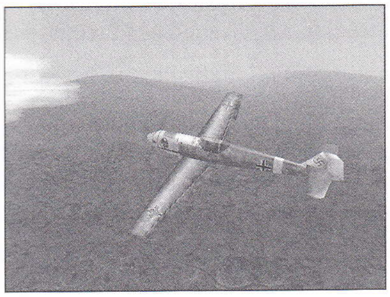
The Dunkirk escape, the evacuation of the British and French troops to England, was made possible by two factors:

1. The initial combat appearance of the British Spitfire over Dunkirk, which provided better air coverage during the evacuation process.
2. The short combat range of the Bf-109, one of its most significant deficiencies, which prevented many of these aircraft stationed at outlying bases from participating in combat sorties over the Dunkirk beaches.

While Allied air units were able to destroy approximately 350 Luftwaffe aircraft during the Battle of France, French losses were enormous and the British alone lost over 450 aircraft. On this basis, there was no question regards the superiority of the Luftwaffe over the Allied air forces.

The most successful German fighter pilot during the Battle of France was Wilhelm Balthasar, who had scored 7 aerial victories during the Spanish Civil War. Balthasar gained 23 more aerial victories and destroyed an additional 13 enemy planes on the ground while flying combat in France. He would later achieve an aerial victory total of 47 prior to losing his life in a combat crash while flying a Bf-109F-4.

Bf 109E-1



The Bf 109E-1 "Emil" fighter was the first large-scale production of the 109 series. It was powered by the long awaited DB 601A-1 engine with an automatic supercharger which eliminated engine cut out at high G. The first 109Es were shipped with the standard pair of cowl mounted and wing mounted 7.9 mm MG 17 machine-guns, but latter deliveries replaced the wing mounted machine-guns with 20-mm MG FF cannon.

Performance:

Max Speed: 467 km/h (290 mph) at sea level
494 km/h at 1000 m (307 mph at 3,280 ft.)
Normal Cruise: 483 km/h at 4000 m (300 mph at 13,120 ft.)
Service Ceiling: 10,500 m (34,450 ft.)
Range: 660 km (410 miles)

Dimensions:

Span: 9.9 m (32 ft. 4 1/2 in.)
Length: 8.8 m (28 ft. 10 1/2 in.)
Height: 2.5 m (8 ft. 2 1/2 in.)

Armament: Two cowl-mounted 7.9-mm MG 17 machine-guns
Two wing-mounted 20-mm MG FF cannon

Fighting with the Bf 109E-1 "Emil": During the battle for the Lowlands and of France there were a wide variety of adversaries, most were outdated and outclassed by the ubiquitous Me 109E. There were a few, however, that are worth special mention; The Morane-Soulnier M.S. 406, the Dewoitine 520, and the Hawker Hurricane.

Morane-Soulnier M.S. 406

France's principal and most numerous fighter during the Battle of France. While it was very reliable, maneuverable and easy to handle, it did not pose a serious threat to the Luftwaffe's Bf-109. Produced in larger numbers than any other French fighter, this workhorse posed little threat to the Emil. With a top speed of 302 mph and its one cannon and two machine-guns, 406 pilots claimed 269 victories.

Dewoitine 520

Considered the finest French fighter of WWII; it was equal to or superior to the Bf-109 except in level/diving speed and could easily out-turn the Messerschmitt. Unfortunately this aircraft was not available in sufficient numbers to affect the outcome of the Battle of France. It had a maximum speed of 329 mph and a service ceiling of over 36,000 feet. It carried one cannon and four 7.5 mm machine-guns. Although the 109E's speed was greater by about 20 mph the 520 could out-turn the Emil with ease and it was easy to handle. If these aircraft had been built in larger quantities the Luftwaffe would have had to pay a much higher price for France.

Hawker Hurricane

The hurricane shot down more German aircraft during the battle of Britain than all other British aircraft and ground defenses combined. More maneuverable than the Bf-109E at altitudes up to 20,000ft. It was definitely slower at all altitudes and possessed a slower climbing ability than the Messerschmitt. It was however, extremely rugged and could absorb a considerable amount of battle damage. In addition, it was a very stable gun platform.

SECTION 10 – BRITAIN

Battle of Britain

It is generally conceded that the Battle
strikes on British shipping in the Englis
command at this time was to lure RAF
where a downed British pilot would
engaging the enemy over the channel
the short ranged Messerschmitt fighters
that RAF Fighter command, aided as t
had been installed in 1939, and the exte
was going to be a very difficult foe
impossible to carry out.

Starting in early August, 1940, the Luf
stations. These strikes proved unsucce
tional; this represented the initial failu
Command could not be conquered b
Luftwaffe High Command then directe
this plan involved the following:

1. Attack and destroy Fighter Comm
2. Attack and destroy Fighter Comm
as fighter direction and control fa
3. Attack and destroy the producti
Fighter Command.

The Luftwaffe code name for impleme
offensive known as "Adler Tag" or "Ea
continued unabated through the early
short when Hitler, in reprisal for an u
Luftwaffe to re-direct their attacks at t
at this specific time RAF Fighter Comm
crippling attacks that the Luftwaffe ha
tories, etc. The decision by Hitler effec
cally erased any hope for the Luftwaff

At the outset of the Battle of Britain, t
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SECTION 10 – BRITAIN

Battle of Britain

It is generally conceded that the Battle of Britain commenced in July of 1940 with air strikes on British shipping in the English Channel. The strategy of the Luftwaffe high command at this time was to lure RAF Fighter Command over the English Channel, where a downed British pilot would have a slim chance for survival. Additionally, engaging the enemy over the channel would also allow more combat participation by the short ranged Messerschmitt fighters. The Luftwaffe High Command soon realized that RAF Fighter command, aided as they were by the chain of radar stations, which had been installed in 1939, and the extensive British fighter direction/control network, was going to be a very difficult foe to conquer; surprise air-strikes were virtually impossible to carry out.

Starting in early August, 1940, the Luftwaffe commenced strikes on the English radar stations. These strikes proved unsuccessful, for the stations continued to be operational; this represented the initial failure of the Luftwaffe. Realizing that RAF Fighter Command could not be conquered by engaging them in aerial combat alone, the Luftwaffe High Command then directed a three pronged attack at their prime enemy; this plan involved the following:

1. Attack and destroy Fighter Command in the air.
2. Attack and destroy Fighter Command on the ground by bombing airfields as well as fighter direction and control facilities.
3. Attack and destroy the production facilities that supplied aircraft/engines to Fighter Command.

The Luftwaffe code name for implementing the first two items on this agenda was the offensive known as "Adler Tag" or "Eagle Day" which began in mid-August, 1940 and continued unabated through the early part of September, 1940. The offensive was cut short when Hitler, in reprisal for an unanticipated bomber raid on Berlin, ordered the Luftwaffe to re-direct their attacks at the London area. This was a critical decision, for at this specific time RAF Fighter Command was barely hanging on due to the previous crippling attacks that the Luftwaffe had carried out on the British airfields, aircraft factories, etc. The decision by Hitler effectively provided a respite for the British and basically erased any hope for the Luftwaffe to defeat the RAF Fighter Command.

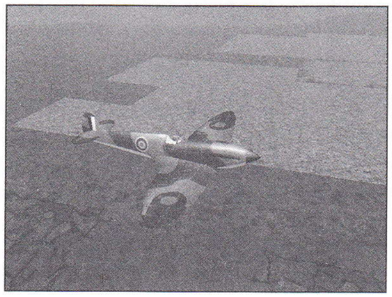
At the outset of the Battle of Britain, the RAF and Luftwaffe were equivalently matched as regards the availability of single-engined, fighter aircraft; the Luftwaffe had 878 planes, while the RAF possessed 848. From July through October, 1940 the Luftwaffe lost approximately 1750 aircraft (mostly Stukas and bombers) in daylight raids against Britain. This represented over half of their total force. In fact, the Stuka formations were literally decimated by Fighter Command, which prompted the Germans to eventually pull this aircraft out of this theater of operations.

The Battle of Britain represented the first major event of WWII wherein the German Luftwaffe did not emerge victorious. While there were many factors which affected the outcome of this battle, most historians tend to agree that the factors listed on the following page were major contributors to the manner in which the Battle of Britain ended:

1. Short range of the Bf-109.
2. Insufficient numbers of fighter aircraft - The German High Command did not take adequate steps to increase fighter production to keep pace with the combat losses.
3. The lack of suitable bomber aircraft - The decision that was made in 1936 to scrap further development of the four-engine, heavy bomber deprived Germany of the ability to deliver adequate bomb-loads on the British Isles.
4. Hitler's decision to switch strike activity from RAF airfields, radar stations, fighter direction/control facilities and aircraft/engine plants, to the area of London; Fighter Command might well have been defeated had the air-strike activity continued on the airfields and other area vital to the air defense effort.
5. The need for the Luftwaffe to divert aircraft resources to support military activity in other operational theaters; e.g., the Balkans, the Mediterranean and Russian theaters.

Listed below are some of the aircraft that participated in the Battle of Britain.

Supermarine Spitfire Mk 1



The Spitfire was faster and much more maneuverable than the Bf-109, with a top speed of 365 mph and a service ceiling of 34,000 feet. It fell behind the Emil in long dives and climbs, however, and it was not unusual to see an Bf-109 pilot diving away from a Spitfire to avoid its eight .303 machine-guns. Do not get into a level turning fight with an experienced Spitfire pilot! Use the Emil's advantage in a diving or even a climbing turn.

British Aircraft

Hawker "Hurricane" — Previous descriptive notes can be found on page 43.

Boulton - Paul Defiant — A single-engine, two-place, low-wing, monoplane that featured a rotating gun-turret that housed four machine guns over the rear cockpit. This aircraft was no match for the German Bf-109.

German Aircraft

Messerschmitt Me-110 — a twin-engine, low-wing monoplane fighter/escort fighter that was definitely inferior to both the Hurricane and Spitfire.

Junkers Ju-87 (Stuka) — a single engine, low-wing monoplane with fixed landing gear; utilized as a dive bomber. Definitely no match for the British Hurricanes or Spitfires. Despite fighter escort, losses became so severe that it was eventually pulled out of action during the Battle of Britain.

Junkers Ju-88 — a fast twin-engine, low-wing monoplane. Considered by many to have been Germany's finest overall aircraft. Utilized in many different roles: night-fighter, bomber, dive-bomber, reconnaissance, etc.

Heinkel He-111 — a twin-engine, monoplane bomber that was in reality a converted Lufthansa transport; it could carry a two ton bomb load.

Dornier Do-17 — a fast twin-engine monoplane bomber that had a one ton bomb load.

■ SECTION 11 – RUSSIAN FRONT

Germany opened its operations on the E
"Operation Barbarossa," and committed over
sented roughly 60% of total Luftwaffe air stre
planes were single-engine fighters. The Luftw
15,000 aircraft of which approximately 5,000

"Barbarossa" commenced at 3:00AM on 6/22
Russian airfields. This strike action was an
destruction of over 1,800 Russian planes for

Subsequent to this opening strike, Germany
the following anti-communist countries: Finla
and Bulgaria, while Spain sent her "Blue Div

Air combat over this eastern battleground was
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SECTION 11 – RUSSIAN FRONT

Germany opened its operations on the Eastern Front (war with Russia) with "Operation Barbarossa," and committed over 1900 aircraft to the battle, which represented roughly 60% of total Luftwaffe air strength at the time; a little over 400 of these planes were single-engine fighters. The Luftwaffe was opposed by a Red Air Force of 15,000 aircraft of which approximately 5,000 were fighters.

"Barbarossa" commenced at 3:00AM on 6/22/41 when the Luftwaffe attacked various Russian airfields. This strike action was an outstanding success and resulted in the destruction of over 1,800 Russian planes for the loss of only 32 Luftwaffe aircraft.

Subsequent to this opening strike, Germany was joined in her fight against Russia by the following anti-communist countries: Finland, Hungary, Romania, Croatia, Slovakia and Bulgaria, while Spain sent her "Blue Division" to assist the German forces.

Air combat over this eastern battleground was unique in that the front extended from the Arctic ocean to the Black Sea; this represented a distance of approximately 2,000 miles. Additionally, combat occurred at relatively low altitudes; usually below 10,000 ft.; often below 5,000 ft. Further, combat speeds generally varied between 100 and 280 mph.

The magnitude of air combat over the Eastern Front was tremendous. It has been estimated that the Russians suffered the loss of approximately 77,000 aircraft during WWII and that about 45,000 of this number fell as victims of the Luftwaffe.

More Luftwaffe aces were produced on the Eastern Front than any other theater of war. In fact, the highest scoring aces of all time were Luftwaffe pilots that flew combat on the Eastern Front. They included, among others, the following: Erich Hartmann (352 victories), Gerhard Barkhorn (301 victories), Gunther Rall (275 victories), Otto Kittel (267 victories), Walter Nowotney (258 victories), Wilhelm Batz (237 victories), Erich Rudorffer (222 victories), Heinz Baer (220 victories), Hermann Graf (212 victories), Anton Hafner (204 victories) and Helmut Lipfert (203 victories).

As a further example of the intensity of the air war on the Eastern Front, consider what is regarded to be the largest and fiercest air battle of all time. It occurred in the vicinity of the Russian city of Kursk, in early July, 1943, approximately 300 miles south of Moscow. During this aerial battle, the Luftwaffe fighter force, consisting of approximately 140 aircraft, faced a mixed force of Russian bombers, ground attack and fighter aircraft that totaled roughly 500 planes. During the ensuing action that followed, the Luftwaffe pilots shot down 432 Russian planes for the loss of 26 Luftwaffe aircraft.

One of the outstanding Luftwaffe fighter pilots that flew combat on the Eastern Front against the Red Air Force was Werner Molders, father of the Luftwaffe "Schwarm." Molders, who had previously flown combat during the Spanish Civil War, Battle of France and Battle of Britain, was the first Luftwaffe pilot to achieve an aerial victory total of 20, 40, 80 and 100 aircraft. He was also the first member of the German Armed Forces to be awarded the "Brillanten," or Diamonds to his Ritterkreuz (Knights Cross).

While serving in combat on the Eastern Front, Molders continued to demonstrate his innovative leadership qualities by flying a Fiesler Storch STOL aircraft on mornings, to assess the battle situation. Afterwards, he would land the Storch, take cover in a foxhole and via radio, direct his pilots in the air to carry out their attack on the enemy, from his vantage point. In effect, he was performing the duties of a Forward Air Controller (FAC), a name that would come into prominence during the Viet Nam War.

Later, after achieving a total of 115 aerial victories, Molders was pulled out of combat and promoted to the rank of full Oberst (Colonel), the youngest in the Luftwaffe, and given a staff position.

In the latter part of 1941, at the age of 28, Werner Molders lost his life in an airplane crash while flying to Berlin to attend the funeral of Ernst Udet.

The Luftwaffe failed to achieve victory over the Red Air Force on the Eastern Front, simply because they could not compete with the numerical superiority that the Soviets achieved in the air. The reason for this superiority was that the Russians moved supplies, factories and production personnel associated with their manufacture of warplanes to the Ural Mountain area, which was beyond the range of the Luftwaffe bombers. Thus, warplane production proceeded unimpaired by bombing raids.

Purportedly, by September, 1941, all of the Russian aircraft that had been operational at the onset of "Operation Barbarossa" had been destroyed by the Luftwaffe, yet the skies over the Eastern Front continued to be dense with Russian planes. The reason for this anomaly was simply that the Russians were able to supply replacement planes and pilots irrespective of their loss rate. In fact, during the last six months of 1941, Russia had been able to increase aircraft production to approximately five times the rate that had existed during the first six months of 1941. This resulted in almost 16,000 planes being manufactured during the latter half of 1941! In addition to these aircraft, Russia received significant numbers of planes from both the U.S. and Britain. The lack of the "Ural Bomber" did have a major impact on Germany's plans of conquest!

On July 11, 1943, the Russians initiated a counter-offensive north of the city of Orel, approximately 250 miles south of Moscow and the Luftwaffe soon found many of their airfields surrounded by Russian troops. To avoid capture, the only alternative for the Luftwaffe personnel was to fly from their airfields to the west. Further Russian advances followed with the German troops retreating westward and the Luftwaffe finally received orders to transfer to the west. This in effect ended the Luftwaffe's activity on the Eastern front.

The Luftwaffe survivors of combat on the Eastern Front soon became involved in combating the thousands of Allied strategic bombers that were pulverizing German cities and factories in around-the-clock bombing raids; the USAAF by day and the RAF by night.

Bf 109F-1

through a hollow propeller hub. Pilots th
than the two wing mounted cannon.

Performance:

Max Speed: 538 km/h at sea level
557 km/h at 3000 m (3
Normal Cruise: 560 km/h at 5000 m
Service Ceiling: 12,000 m (39,370 f
Range: 710 km (442 miles)

Dimensions:

Span: 9.924 m (32 ft. 61/2 in.)
Length: 9.048 m (29 ft. 8 in.)
Height: 2.6 m (8 ft. 6 1/2 in.)

Armament: Two cowl-mounted 7.9-mm
One 20-mm cannon firing th

Fighting with the Bf 109F

The Bf 109F was faster with a higher serv
verable as the earlier 109s. One of its pri

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STOL aircraft on mornings, to
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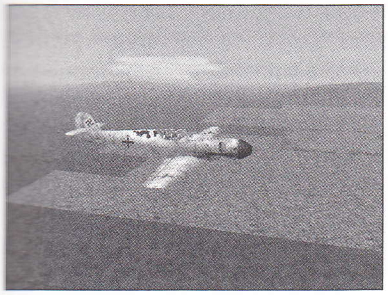
Bf 109F-1



The Bf 109F incorporated many airframe changes that would stay with all of the following 109 models. The underwing radiators were decreased in height. The aircraft received a new streamlined cowling, and the air intake for the supercharger was moved further into the airstream to increase its effectiveness. The wing tips also took on an elliptical shape to increase wing surface and reduce wing loading. The F version reduced its armament to only one cannon firing through a hollow propeller hub. Pilots thought the concentrated firepower was better than the two wing mounted cannon.

Performance:

Max Speed: 538 km/h at sea level (334 mph)
557 km/h at 3000 m (346 mph at 9,8403ft.)
Normal Cruise: 560 km/h at 5000 m (365 mph at 16,400ft.)
Service Ceiling: 12,000 m (39,370 ft.)
Range: 710 km (442 miles)

Dimensions:

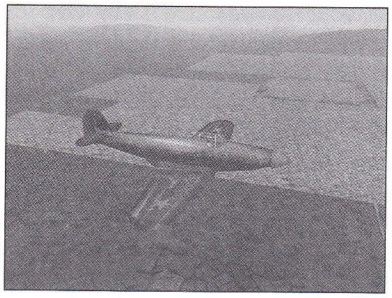
Span: 9.924 m (32 ft. 61/2 in.)
Length: 9.048 m (29 ft. 8 in.)
Height: 2.6 m (8 ft. 6 1/2 in.)

Armament: Two cowl-mounted 7.9-mm MG 17 machine-guns
One 20-mm cannon firing through the propeller shaft

Fighting with the Bf 109F

The Bf 109F was faster with a higher service ceiling, but in general were not as maneuverable as the earlier 109s. One of its primary adversaries was the P-39Q Airacobra.

Bell P-39Q Airacobra



Over 4,750 American made P-39s were sent to Russia under the lend lease. Although considered a failure by most authorities, the aircraft fit in well with Russia's low-level tactics. The Airacobra had a top speed of 376 mph at 15,000 feet and possessed a 30-mm cannon fired through the nose and two .50 cal. wing-mounted machine-guns. Below 15,000 feet the P-39 flies much like a 109, and great caution should be used when engaged at these low altitudes, but above 15,000 feet the mid-engine fighter's performance dropped off sharply.

Russian Aircraft

1. Polikarpov I-15 "Chato" - A bi-plane fighter first utilized by the Loyalist forces during the Spanish Civil War. It was of wood/metal construction and powered with a copy of the American Wright Cyclone 715 hp, 9 cylinder radial engine. It was inferior to the Messerschmitt Bf-109; however, due to its excellent maneuverability and slower speed, it was a difficult target to bring down.
2. Polikarpov I-16/I-17 "Moska"/"Ratta" - The first low-wing fighter, with retractable landing gear, to see operational service with any air force. The I-16 was powered with an air-cooled, radial, engine whereas the I-17 was powered by an in-line engine. These aircraft were widely used by the Russians during "Operation Barbarossa." Due to their slow speed and very short turning radius, they presented very difficult targets.
3. Ilyushin IL-2 "Shturmovik" - A very heavily armed and armored ground-attack aircraft that played a pivotal role in defeating Germany on the Eastern Front. Considered by the Luftwaffe, to be the most difficult Russian aircraft to shoot down.
4. MiG-3 - A very capable single-engine fighter that was considered, prior to 1943, superior to the Bf-109 above 16,000 ft.
5. Yak-3 - Considered one of the most potent of the Russian fighters due to its speed and maneuverability. Up to 20,000 ft., it had a smaller turning radius, better climb rate and acceleration than the Bf-109G.
6. Lavochkin La-5/7 - Flown by many Russian aces, this fighter was powered by an air-cooled, radial engine and was capable of extremely tight, low-altitude turns. The -7 design had a fuel-injected engine that incorporated a power-boost system that would enhance performance for short periods of time.
7. Bell P-39 "Airacobra" - This American plane was utilized by the Red Air Force with great success and proved to be the 109's match at altitudes below 15,000 feet.

Subsequent to America's entry into WW
bombing campaign to destroy Germany's
attempted daylight bombing of enemy fa
Wilhelmshaven, Germany; however, the a
the defending Luftwaffe fighters. It was
Bomber Command elected to restrict fut
USAAF officials, however, were strongly p
and, after an analysis of RAF night bombi
of bombs dropped fell within 5 miles of th
USAAF would carry out daytime precisi
strike at night. Thus, the air-war scenari

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the Republic P-47, this aircraft was also

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The following facts are presented as an
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Gradually, the Allies continued to take t
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SECTION 12 – WESTERN FRONT

Subsequent to America's entry into WWII, the U.S. and Britain planned a strategic bombing campaign to destroy Germany's ability to produce war material. Britain had attempted daylight bombing of enemy facilities as early as 12/18/39, with a strike on Wilhelmshaven, Germany; however, the attacking bomber force was badly mauled by the defending Luftwaffe fighters. It was the direct result of this mission that RAF Bomber Command elected to restrict future bombing activity to night missions only. USAAF officials, however, were strongly postured towards daylight precision bombing and, after an analysis of RAF night bombing photographs revealed that only about 30% of bombs dropped fell within 5 miles of the target area, it was mutually agreed that the USAAF would carry out daytime precision bombing missions, while the RAF would strike at night. Thus, the air-war scenario over Western Europe was established.

While initial USAAF daylight missions were devoid of fighter escort, it was soon learned that the tenacious defense of the Luftwaffe fighters resulted in unacceptable bomber losses. Future missions then entailed fighter-escort for the bombers, to the extent afforded by the combat range of the fighters. The escort missions commenced in January, 1943 with Lockheed P-38's and in the autumn of 1943, with the arrival of the Republic P-47, this aircraft was also employed as a bomber escort.

In January of 1944, with the arrival of the long-range North American P-51 Mustang, USAAF daylight bombing missions received complete fighter-escort (all the way to the target and back). With this additional fighter coverage, bomber losses decreased accordingly and the Luftwaffe suffered additional attrition in both planes and pilots.

The following facts are presented as an example of the air superiority that was experienced by the Allies over the Luftwaffe at this time:

1. Between January and April, 1944, the Luftwaffe lost over 1,000 fighter pilots.
2. In February, 1944, the USAAF carried out a bombing mission over the European continent that involved 940 four-engine bombers and 700 fighters (P-38's, P-47's and P-51's) wherein only 21 bombers were lost.

Gradually, the Allies continued to take their toll of Luftwaffe planes and pilots, resulting in smaller and smaller number of fighter aircraft getting aloft to attack the bomber fleets. This resulted in a tremendous impact on Germany's production of war material with the effect being more and more weapon shortages at the battlefronts. In May of 1944, the Allies shifted their bombing of aircraft factories, airfields and communications to fuel production facilities. This resulted in the grounding of many Luftwaffe aircraft due to lack of fuel. On New Years Day, 1945, the Luftwaffe launched its last major attack of the war. It was labeled "Operation Bodenplatte" and involved all of the Luftwaffe's remaining fighter aircraft, which numbered approximately 750 planes. The surprise dawn attack was directed at Allied airfields in Belgium, The Netherlands and Luxembourg and resulted in the destruction of or severe damage to approximately 900 Allied aircraft.

After the New Year's Day raid, Adolph Galland, General der Jagdwaffe (General of the Fighter Arm) had a heated discussion with Hermann Göring (Head of the Luftwaffe) as to whether the new Me-262, twin-engine jet fighter should be utilized as a fighter or bomber. Galland felt strongly that the aircraft should be used as a fighter to combat the endless streams of Allied bombers that were taking a terrible toll of German factories and cities. In anger, Göring removed Galland as General of the Fighter Arm and gave him a Staffel (squadron) equipped with Me-262's. This squadron, which Galland commanded till the end of the war, contained some of the finest fighter pilots in the Luftwaffe and was known as Adolph Galland's "Squadron of Experts."

It was shortly after Galland's banishment by Göring that the "Mutiny of the Fighters" occurred wherein the Luftwaffe fighter pilots elected a member of their group to present their grievances to Göring concerning his mismanagement of the Luftwaffe and suggested items of reform, but to no avail. This mutiny in the ranks was something that had been brewing for some time, for Göring would not listen to his experts nor admit his own mistakes. Both Ernst Udet and Hans Jeschonnek, two high ranking Luftwaffe officials, had both had problems with Göring and both men reportedly committed suicide.

By May 2, 1945, the Soviet Army had captured Berlin and the sky over Germany resembled one huge battlefield. The Luftwaffe pilots retreated from both the east and west, from airfield to airfield, with their aircraft often inoperative due to lack of fuel/ammunition/parts/pilots. Finally, surrender to the Allies occurred and the activity of the Luftwaffe during WWII ended; they were defeated; however, they had distinguished themselves greatly!

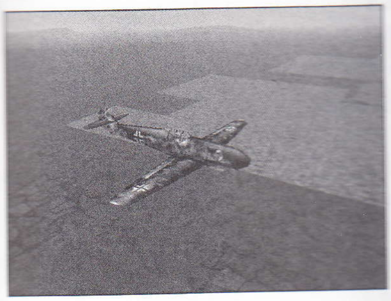
The following data highlight the performance of the Luftwaffe during WWII:

1. The German Luftwaffe was the only air force where WWI pilots engaged in aerial combat during WWII.
2. Outnumbered during most of the war (as much as 20 to 1), German fighter pilots were forced to fly as many as five missions a day, which often resulted in the accumulation of 500 to 1,000 missions during their combat career.
3. In the European/Mediterranean Theater there were approximately 1540 Allied pilots that achieved the status of ace. The Luftwaffe, during WWII, produced over 3,000 aces.
4. The top Allied ace of WWII (a Russian) scored 62 aerial victories; whereas the top Luftwaffe ace, Erich Hartmann ("Black Devil of the Ukraine") scored 352 aerial victories during 1,425 combat missions.
5. Of 28,000 men who trained as fighter pilots in the German Luftwaffe, less than 1400 survived WWII; this equates to a mortality rate approximating 95%!

The basic elements that comprised the Jagdwaffe (Hunting Arm/Fighter Arm) division of the German Luftwaffe are denoted below:

1. Rotte - an element comprised of two aircraft, a leader (attacker) and his wing-man (defender).
2. Schwarm - a formation comprised of 4 aircraft (two Rotte); an attack Rotte and a defensive Rotte.
3. Staffel - comprised of from 12 to 16 aircraft (3 to 4 Schwarm).
4. Gruppe - comprised of from 36 to 48 aircraft (3 Staffel).
5. Jagdgeschwader - comprised of from 108 to 192 aircraft (3 to 4 Gruppen). This element represented the largest mobile, homogeneous unit in the Jagdwaffe (Fighter Arm).

Bf 109G-1



Performance:
Max Speed: 547 km/h (340
590 km/h at 2000
Normal Cruise: 560 km/h at
Service Ceiling: 11,550 m
Range: 1000 km (20 miles)

Dimensions:
Span: 9.924 m (32 ft. 61/2 in.)
Length: 9.048 m (29 ft. 8 in.)
Height: 2.6 m (8 ft. 2 1/2 in.)

Armament: Two cowl-mounted
One 20-mm cannon

Messerschmitt Me 262

1. Poor acceleration relative to
2. Poor engine reliability; time
the engines were prone to
vated by rapid throttle
3. Allied propeller-driven
4. At high speed (approx. Mach
tended to "porpoise."
5. Flight duration was

as General of the Fighter Arm and
2's. This squadron, which Galland
of the finest fighter pilots in the
adron of Experts."

that the "Mutiny of the Fighters"
member of their group to present
nent of the Luftwaffe and suggest-
ne ranks was something that had
n to his experts nor admit his own
high ranking Luftwaffe officials,
portedly committed suicide.

rlin and the sky over Germany
retreated from both the east and
ften inoperative due to lack of
e Allies occurred and the activity
ated; however, they had distin-

uftwaffe during WWII:

where WWI pilots engaged in

s 20 to 1), German fighter pilots
which often resulted in the accu-
mbat career.

ere approximately 1540 Allied
fe, during WWII, produced over

erial victories; whereas the top
he Ukraine") scored 352 aerial

e German Luftwaffe, less than
ate approximating 95%!

ing Arm/Fighter Arm) division

er (attacker) and his wing-man

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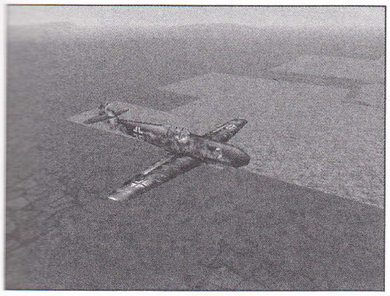
Schwarm).

ffel).

ircraft (3 to 4 Gruppen). This
neous unit in the Jagdwaffe

Bf 109G-1



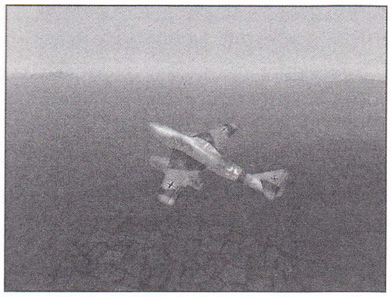
The Bf 109G incorporated the DB 605A engine which was more powerful, but also heavier. As the weight of the 109 continued to grow its maneuvering capabilities were reduced. The 109G was also fitted for prolonged high altitude flight by pressurizing the cockpit.

Performance:
Max Speed: 547 km/h (340 mph) at sea level
590 km/h at 2000 m (366mph at 6560ft.)
Normal Cruise: 560 km/h at 5000 m (365 mph at 16,400ft.)
Service Ceiling: 11,550 m (37,890 ft.)
Range: 1000 km (20 miles)

Dimensions:
Span: 9.924 m (32 ft. 61/2 in.)
Length: 9.048 m (29 ft. 8 in.)
Height: 2.6 m (8 ft. 2 1/2 in.)

Armament: Two cowl-mounted 7.9-mm MG 17 machine-guns
One 20-mm cannon firing through the propeller shaft

Messerschmitt Me 262



The Me - 262 possessed a speed advantage of approximately 100 mph over the fastest contemporary Allied propeller-driven fighters. In addition, its climb rate was superior to these aircraft. There were, however, some negative aspects to the flight performance of this aircraft:

1. Poor acceleration relative to throttle response; thrust build-up was slow.
2. Poor engine reliability; time between overhaul was approximately 10 hours and the engines were prone to stalls, surges, and fires. These conditions were aggravated by rapid throttle movements.
3. Allied propeller-driven fighters possessed superior maneuverability.
4. At high speed (approx. Mach 0.84) gun platform stability was affected; the aircraft tended to "porpoise."
5. Flight duration was appreciably less than the Allied propeller-driven fighters.

Performance:

Max Speed: 538 km/h (334 mph) at sea level
557 km/h at 3000 m (346 mph at 9,8403ft.)
Normal Cruise: 560 km/h at 5000 m (365 mph at 16,400ft.)
Service Ceiling: 12,000 m (39,370 ft.)
Range: 710 km (442 miles)

Dimensions:

Span: 9.924 m (32 ft. 61/2 in.)
Length: 9.048 m (29 ft. 8 in.)
Height: 2.6 m (8 ft. 6 1/2 in.)

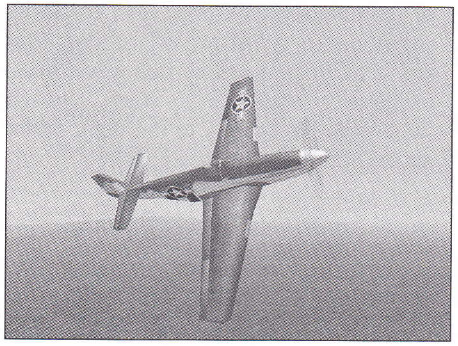
Armament: Four nose mounted 30-mm cannon

Fighting with the Me - 262

Considering the aforementioned flight characteristics of the Me - 262, the following are recommended rules to follow when flying this aircraft in combat:

1. Always keep your speed up.
2. Avoid rapid throttle movements.
3. Always monitor your fuel supply.
4. Remember that you are most susceptible at low speed such as during landing/take-off operations. So be certain to avoid engaging the enemy while in the "pattern."
5. When making a firing-pass, make certain to keep your airspeed below that which can affect gun platform stability (induce a "porpoise" action to the aircraft).

North American P-51D Mustang



The Mustang is widely considered the best fighter of the Second World War. The P-51 had top speed of 395 mph at 25,000 feet and a service ceiling of 41,900 feet. Above 20,000 feet the 109 was out flown in almost every area, but below 15,000 feet the P-51's advantage disappeared. The one advantage the 109 has at high altitude is the ability to turn more tightly without stalling. Great care should be taken when fighting any pilot in a P-51.

German Aircraft

1. Messerschmitt Bf-109 E,F,G - see d
2. Messerschmitt Me-110 - a twin-eng
er that was definitely inferior to bo
3. Messerschmitt Me-163 - a single se
endurance of approximately seven
4. Messerschmitt Me-262 - a twin-jet
100 mph speed advantage over the
the first jet aircraft in the world to
5. Messerschmitt Me-410 - a more
same configuration.
6. Focke-Wulf 190 - along with the B
primary propeller-driven, piston-e
ants: the short-nosed 190 powere
190 powered by an in-line, inve
designated as the Fw-190D.
7. Arado Ar.234 "Blitz" - a twin-eng
world to go into operational ser
naissance missions.
8. Dornier Do.17 - (see previous des
9. Dornier Do.217 - a redesign of the
ing combat roles: bomber, dive-
night-fighter.
10. Heinkel He.219 - a twin-engine,
heavily armed, and considered to
11. Junkers Ju.188 - a redesign of th
torpedo-bomber, intruder, night-f

British Aircraft

1. Hawker Hurricane - (see previous
2. Supermarine Spitfire - (see previo
3. de Havilland "Mosquito" - a very
of wooden construction and utiliz
fighter, night-fighter, and reconna
4. Bristol "Beaufighter" - a twin-eng
craft that was utilized in the fol
fighter-bomber, torpedo-bomber,
5. Hawker "Typhoon" - a singl
interceptor/fighter-bomber; it wa
configured, in-line Napier Sabre
6. Hawker "Tempest" - a singl
interceptor/fighter-bomber; pow
was very successful in intercep
down 638 of 1,771 that were lau

9,8403ft.)
at 16,400ft.)

of the Me - 262, the following are
ft in combat:

at low speed such as during
oid engaging the enemy while in

your airspeed below that which
oise" action to the aircraft).

Mustang is widely considered the
fighter of the Second World War.
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as at high altitude is the ability to
more tightly without stalling.
care should be taken when fight-
y pilot in a P-51.

German Aircraft

1. Messerschmitt Bf-109 E,F,G - see descriptive sections on pages 42,48, and 52.
2. Messerschmitt Me-110 - a twin-engine, low-wing monoplane fighter/escort fighter that was definitely inferior to both the Hurricane and Spitfire.
3. Messerschmitt Me-163 - a single seat, rocket engine powered interceptor with an endurance of approximately seven and a-half minutes.
4. Messerschmitt Me-262 - a twin-jet interceptor aircraft that had an approximate 100 mph speed advantage over the fastest propeller driven, Allied fighters; it was the first jet aircraft in the world to enter squadron service.
5. Messerschmitt Me-410 - a more advanced version of the Me-110, utilized the same configuration.
6. Focke-Wulf 190 - along with the Bf-109, this aircraft represented the Luftwaffe's primary propeller-driven, piston-engine fighters. There were basically two variants: the short-nosed 190 powered by a BMW radial engine and the long-nosed 190 powered by an in-line, inverted V-12, Junkers Jumo engine, which was designated as the Fw-190D.
7. Arado Ar.234 "Blitz" - a twin-engine jet aircraft that was the second jet in the world to go into operational service. It was used primarily for bomber/reconnaissance missions.
8. Dornier Do.17 - (see previous descriptive notes).
9. Dornier Do.217 - a redesign of the basic Do.17 which was utilized in the following combat roles: bomber, dive-bomber, patrol bomber, torpedo-bomber and night-fighter.
10. Heinkel He.219 - a twin-engine, propeller-driven monoplane; it was very fast, heavily armed, and considered to be the best of the Luftwaffe's night fighters.
11. Junkers Ju.188 - a redesign of the Ju.88 aircraft that was utilized as a bomber, torpedo-bomber, intruder, night-fighter and for reconnaissance.

British Aircraft

1. Hawker Hurricane - (see previous descriptive notes).
2. Supermarine Spitfire - (see previous descriptive notes)
3. de Havilland "Mosquito" - a very fast, twin engine, monoplane aircraft; primarily of wooden construction and utilized in a number of combat roles such as bomber, fighter, night-fighter, and reconnaissance.
4. Bristol "Beaufighter" - a twin-engine, powerful and very versatile monoplane aircraft that was utilized in the following combat roles: day/night/ escort fighter, fighter-bomber, torpedo-bomber, ground-attack and anti-shipping aircraft.
5. Hawker "Typhoon" - a single-engine aircraft that was utilized as an interceptor/fighter-bomber; it was powered by the unconventional 24 cylinder, H configured, in-line Napier Sabre engine.
6. Hawker "Tempest" - a single-engine aircraft that was utilized as an interceptor/fighter-bomber; powered by the Napier Sabre engine. This aircraft was very successful in intercepting the German V-1 "Flying Bombs," shooting down 638 of 1,771 that were launched by the Germans.

7. Gloster "Meteor" - the only Allied jet-fighter to see service in WWII. The Luftwaffe Me. 262 had better performance so the Meteor was utilized to intercept V-1 "Flying Bombs."
8. Vickers "Wellington" - a twin-engine medium bomber that incorporated a unique "geodetic" design which gave it exceptional strength and the capability to absorb considerable battle damage.
9. Short "Stirling" - the first British four-engine heavy bomber; powered by four radial engines.
10. Handley Page "Halifax" - a four-engine heavy bomber. The early Mk 1 (1940) was powered by Rolls-Royce Merlin X in-line engines while the later Mk 11 (1944) was powered by Bristol Hercules XVI radial engines.
11. Avro "Lancaster" - a four-engine heavy bomber. The early Mk1 (1942) was powered by Rolls-Royce Merlin XX in-line engines while the later Mk II (1943) was powered by Bristol Hercules radial engines.

American Aircraft

1. Boeing B-17 "Flying Fortress" - a four-engine heavy bomber powered by Wright Cyclone R-1820 radial engines.
2. Consolidated B-24 "Liberator" - a four-engine heavy bomber powered by Pratt & Whitney R-1830 radial engines.
3. North American Aviation B-25 "Mitchell" - a twin-engine medium bomber powered by Wright R-2600 radial engines.
4. Martin B-26 "Marauder" - a twin-engine medium bomber powered by Pratt & Whitney R-2800 radial engines.
5. Douglas A-26 "Invader" - a twin-engine aircraft that was utilized in an attack/close air-support role. It was an outstanding aircraft as warranted by it's usage in WWII, Korea and Viet Nam. It was powered by Pratt & Whitney R-2800 radial engines.
6. North American Aviation A-36 "Invader" - the dive bomber version of the P-51 Mustang. The A-36 entered the USAAF inventory prior to the P-51A and was powered with the Allison -1710, V-12 liquid-cooled engine.
7. Lockheed P-38 "Lightning" - a twin engine fighter that could be used in a variety of roles including air superiority and ground support. Four .50 caliber machine guns and a 20 mm cannon made the P-38 an extremely dangerous opponent.
8. North American Aviation P-51 "Mustang" - a single-engine fighter aircraft that possessed outstanding speed, range and maneuverability; often described as the best fighter of WWII. The P-51A was powered with the Allison -1710 V-12 engine while the P-51B and subsequent models were powered with the British Rolls-Royce Merlin V-12 engine.
9. Republic P-47 "Thunderbolt" - the heaviest single-engine fighter of WWII; heavily armed with eight, wing-mounted 50 caliber machine guns, it was very sturdy and could absorb a great deal of battle damage. It was powered with a Pratt & Whitney R-2800 radial engine.
10. Northrop P-61"Black Widow" - a twin-engine, heavily armed aircraft that was the first American plane designed exclusively as a night-fighter; it was powered by Pratt & Whitney R-2800 radial engines.

APPENDIX A – LUFTWAFFE VOC

Abschrift - Combat Report.

Abschuss - Luftwaffe term for the destru

Abschussmeldung - Victory Report.

Adler Tag - Eagle Day; code name for A
day on which the Luftwaffe instituted figh
Battle of Britain.

Alarmstart - A call to General Quarters,

Alte Adler - Old eagles (WWI pilots).

Auto - A bomber.

Beule - "Bump;" associated with certai
craft, wherein fuselage bumps were inc
clearance for larger caliber, cowl-mount
used to identify this version of the Bf-10

Blue Max - Pour le Merite; awarded onl
oration of WWI except for some speci
After WWI it was discontinued.

Brillanten - Knight's Cross of the Iron C

C-Amt - A clandestine technical departme
whose purpose was to evaluate and sele

Cyclist - German fighter aircraft.

Devil-Egg - 4 1/2 lb., finned, fragmentat

Eichenlaub - Knight's Cross of the Iron Cross

Eiserne Kreuz - Iron Cross.

Eismeer - Arctic Sea.

Erganzungsgruppe - Replacement Trai

Erprobungsgruppe - Testing Group.

Fahnenjunker - A officer cadet.

Fahnrich - A junior officer

Fat Auto -A heavy bomber

Feldwebel - Sergeant.

Flieger Division - Air Division.

see service in WWII. The Luftwaffe
eor was utilized to intercept V-1

omber that incorporated a unique
ength and the capability to absorb

heavy bomber; powered by four

omber. The early Mk 1 (1940) was
nes while the later Mk 11 (1944)
gines.

: The early Mk1 (1942) was pow-
while the later Mk II (1943) was

eavy bomber powered by Wright

eavy bomber powered by Pratt &

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craft that was utilized in an
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port. Four .50 caliber machine
remely dangerous opponent.

ngle-engine fighter aircraft that
erability; often described as the
h the Allison -1710 V-12 engine
owered with the British Rolls-

-engine fighter of WWII; heavi-
achine guns, it was very sturdy
It was powered with a Pratt &

vily armed aircraft that was the
ght-fighter; it was powered by

APPENDIX A – LUFTWAFFE VOCABULARY

Abschrift - Combat Report.

Abschuss - Luftwaffe term for the destruction of an enemy plane in combat.

Abschussmeldung - Victory Report.

Adler Tag - Eagle Day; code name for August 13, 1940 which represented the initial day on which the Luftwaffe instituted fighter attacks against British airfields during the Battle of Britain.

Alarmstart - A call to General Quarters, similar to an Allied "scramble."

Alte Adler - Old eagles (WWI pilots).

Auto - A bomber.

Beule - "Bump;" associated with certain variants of the Bf-109G Messerschmitt aircraft, wherein fuselage bumps were incorporated to provide breech and ammo-track clearance for larger caliber, cowl-mounted, machine guns. The nickname "Beule" was used to identify this version of the Bf-109G.

Blue Max - Pour le Merite; awarded only to officers and was the highest German decoration of WWI except for some special medals reserved for nobility and generals. After WWI it was discontinued.

Brillanten - Knight's Cross of the Iron Cross, with Oak Leaves, Swords and Diamonds.

C-Amt - A clandestine technical department within the German Air Force, prior to WWII, whose purpose was to evaluate and select aircraft for the new German Luftwaffe.

Cyclist - German fighter aircraft.

Devil-Egg - 4 1/2 lb., finned, fragmentation bomb.

Eichenlaub - Knight's Cross of the Iron Cross with Oak Leaves.

Eiserne Kreuz - Iron Cross.

Eismeer - Arctic Sea.

Erganzungsgruppe - Replacement Training Group.

Erprobungsgruppe - Testing Group.

Fahnenjunker - A officer cadet.

Fahnrich - A junior officer

Fat Auto -A heavy bomber

Feldwebel - Sergeant.

Flieger Division - Air Division.

Fliegerkorps - Air Corps.

Freie Jagd - Free hunting/fighter sweep.

Furniture Van - Friendly twin-engine aircraft.

Gefreiter - Lance Corporal/Private First Class.

Geschwader - Wing (120 aircraft).

Geschwaderkommodore - Wing Commander.

Geschwaderstab - Wing Staff.

Gruppe - Group; composed of three Staffeln (36 to 48 aircraft).

Gruppenkommandeur - Group Commander.

Hakenkreuz - Black Swastika.

Hanni - Radio code word for altitude (always measured in meters).

Hauptmann - Captain.

Herr -Mister.

Horridoh - Victory cry of the German Fighter Arm; when a German fighter pilot scored a victory, he would call Horridoh! over the radio.

Indians - Radio code word for enemy planes.

Inspecteur der Jagdflieger - Inspector of Fighters.

Inspecteur der Schlachtflieger - Inspector of Ground Attackers.

Ivans - Russian aircraft.

Jagdbomber (Jabo) - Fighter-bomber.

Jagdflieger - Fighter pilot.

Jagdführer (Jafu) - Fighter Leader.

Jagdgeschwader - Fighter Wing; consisted of 3 or 4 Gruppen (108 to 192 aircraft) and was the largest mobile, homogeneous unit in the Jagdwaffe (Hunting Arm of the Luftwaffe).

Jagdgruppen - Fighter Groups.

Jagdwaffe - Hunting Arm/Fighter Arm.

Kampfgeschwader - Bomber Wing.

Kampfgruppe - Bomber Group.

Kette - A V-formation of three aircraft.

Kriegsmarine - German Navy.

Lehrgeschwader - Operational Training

Leutnant - 2nd Lieutenant.

Luftflotten - Air Fleet.

Luftstreitkrafte - Imperial Air Service

Mill - Aircraft/plane.

Nachtjagdgeschwader - Night Fighter

Nahaufklarungsgruppe - Close Reconn

Oberbefehlshaber der Luftwaffe - Comm

Oberfeldwebel - Master Sergeant.

Oberkommando des Heeres - High Com

Oberkommando der Luftwaffe - High C

Oberkommando der Marine - High Com

Oberleutnant - 1st Lieutenant.

Oberst - Colonel.

Oberstleutnant - Lieutenant Colonel.

Picnic Ground - Radio code word for a

Rammkommando Elbe - Special Luftw
WWII and composed of young volunte
credit. Their only operational mission
120 pilots returned from an intercept

Reichsluftfahrtministerium - German

Ritterkreuz - Knight's Cross of the Iron C

Rotte - A two plane element formati
(wingman).

Rottenflieger - Wingman.

Schlachtgeschwader - Ground Suppor

Schnelles Kampfgeschwader - Fast B

Schwarm - A four plane formation
defensive Rotte).

Schwerten - Knight's Cross of the Iron Cros

Split S - A basic combat maneuver
achieved (in level flight) by rolling inve
eling out in the reverse direction.

48 aircraft).

sured in meters).

when a German fighter pilot scored

d Attackers.

Gruppen (108 to 192 aircraft) and
Jagdwaffe (Hunting Arm of the

Lehrgeschwader - Operational Training Wing.

Leutnant - 2nd Lieutenant.

Luftflotten - Air Fleet.

Luftstreitkrafte - Imperial Air Service (German Air Force WWI).

Mill - Aircraft/plane.

Nachtjagdgeschwader - Night Fighter Wing.

Nahaufklarungsgruppe - Close Reconnaissance Group.

Oberbefehlshaber der Luftwaffe - Commander in Chief of the Air Force.

Oberfeldwebel - Master Sergeant.

Oberkommando des Heeres - High Command of the Army.

Oberkommando der Luftwaffe - High Command of the Air Forces.

Oberkommando der Marine - High Command of the Navy.

Oberleutnant - 1st Lieutenant.

Oberst - Colonel.

Oberstleutnant - Lieutenant Colonel.

Picnic Ground - Radio code word for airfield.

Rammkommando Elbe - Special Luftwaffe Fighter Unit; formed towards the end of WWII and composed of young volunteers who had but one or two solo flights to their credit. Their only operational mission occurred on April 7, 1945, wherein only 15 of 120 pilots returned from an intercept mission.

Reichsluftfahrtministerium - German Air Ministry.

Ritterkreuz - Knight's Cross of the Iron Cross.

Rotte - A two plane element formation consisting of a leader and his Rottenflieger (wingman).

Rottenflieger - Wingman.

Schlachtgeschwader - Ground Support Wing.

Schnelles Kampfgeschwader - Fast Bomber Wing.

Schwarm - A four plane formation consisting of two Rotte (an attack Rotte and a defensive Rotte).

Schwerten - Knight's Cross of the Iron Cross with Oak Leaves and Swords.

Split S - A basic combat maneuver wherein a reversal in flight direction occurs; achieved (in level flight) by rolling inverted, pulling back on the control column and leveling out in the reverse direction.

Staffel - Squadron; composed of three or four Schwarm (12 to 16 aircraft).

Staffelkapitan - Squadron Commander.

Stukageschwader - Dive Bomber Wing.

Stürtzkampflugzeug - Stuka (dive bomber).

Tag der Jagdflieger - Fighter Pilot's Day; most successful day for the Jagdwaffe during the Battle of France.

Technischer Offizier - Technical Officer.

Transportgeschwader - Transport Wing.

Tyrolean - Novice or beginner.

Unteroffizier - Corporal.

Viktor - Radio code word meaning "Roger" or understood.

Wilde Sau - Wild Boar; a name associated with German night-fighters.

Zerstörergeschwader - Long-range Fighter Wing.

Luftwaffe Ranks with Royal Air Force(RAF) and United States Army Air Force(USAAF) Equivalents:

LUFTWAFFE RANK	LUFTWAFFE ABBREVIATION	RAF RANK	USAAF RANK
Oberfahnrich	Ofhr.	—	Cadet
Feldwebel	Fw.	Sergeant	Sergeant
Oberfeldwebel	Obfw.	Sergeant Major	Master Sergeant/ Warrant Officer
Gefreiter	Gefr.	Lance Corporal	Private First Class
Unteroffizier	Uffz.	Corporal	Corporal
Leutnant	Lt.	Pilot Officer	2nd Lieutenant
Oberleutnant	Oblt.	Flying Officer	Lieutenant
Hauptmann	Hptm.	Flight Lieutenant	Captain
Major	Maj.	Squadron Leader	Major
Oberstleutnant	Oberstlt.	Wing Commander	Lt. Colonel
Oberst	Oberst	Group Captain	Colonel
General Major	Gen.	Maj. Air Commodore	Major General
Generalleutnant	Gen. Lt.	Air Vice Marshal	Lieutenant General
General der Flieger	Gen. d. Fl.	Air Marshal	General
General-Oberst	Gen. Oberst.	Air Chief Marshal	—
General-Feldmarschall	Gen. Feldm.	Marshal of the RAF	Five Star General

■ APPENDIX B – LUFTWAFFE CO

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chwarm (12 to 16 aircraft).

ccessful day for the Jagdwaffe during

derstood.

erman night-fighters.

nited States Army Air Force(USAAF)

AF RANK	USAAF RANK
—	Cadet
rgeant	Sergeant
rgeant Major	Master Sergeant/ Warrant Officer
nce Corporal	Private First Class
rporal	Corporal
ot Officer	2nd Lieutenant
ing Officer	Lieutenant
ght Lieutenant	Captain
uadron Leader	Major
ng Commander	Lt. Colonel
oup Captain	Colonel
j. Air Commodore	Major General
Vice Marshal	Lieutenant General
Marshal	General
Chief Marshal	—
rshal of the RAF	Five Star General

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